



**Fourth Quarter (December) 2006  
Groundwater Monitoring Report  
Rose Township Demode Road Site  
913 Demode Road  
Holly, Michigan**

*Prepared For:*

Rose Township Settling Defendants  
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Auburn Hills, MI 48326

*Prepared By:*

Earth Tech, Inc.  
36133 Schoolcraft  
Livonia, MI 48150

**March 9, 2007**



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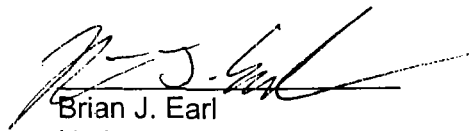
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## **1.0 INTRODUCTION**

This groundwater monitoring report documents field activities and analytical results from the December 2006 (Fourth Quarter) groundwater sampling activities conducted at the Rose Township Demode Road Site (Site), located at 913 Demode Road, Holly, Michigan (Figure 1). A total of 32 groundwater monitoring wells and two active extraction wells were purged and sampled between December 11 and 14, 2006, using either low-flow pumping methods or by use of natural artesian conditions. Monitoring well DNR-6 was also purged but had insufficient recovery to collect a sample. Pumping wells PW-1, PW-4, and PW-6 were also sampled, as part of the groundwater treatment system capture zone monitoring, currently in progress at the Site. Groundwater level measurements were collected from 110 groundwater monitoring wells on December 15, 2006. This report summarizes the methods and procedures used during the monitoring event and the results of the December 2006 field activities.

### **1.1 SITE DESCRIPTION AND BACKGROUND**

The Site is comprised of approximately 110 acres and is located in the northwestern corner of Oakland County. Regional topography consists primarily of broad flat plains with numerous shallow depressions and valleys occupied by lakes, ponds, wetlands, and streams. These plains are traversed by a series of southwest to northeast trending ridges formed by glacial end moraines. The topography of Oakland County and all of southeastern Michigan is dominated by glacial features created during the retreat of the Saginaw lobe of the Laurentide ice sheet during the Wisconsin Glacial Stage (approximately 10,000 to 20,000 years ago). The regional ground surface elevation ranges from approximately 630 to 1,220 feet above mean sea level (ft. AMSL). The area receives on average 30 inches of precipitation per year. Average monthly temperatures range from 23 °F (January) to 72 °F (July).

The Site was used as an unlicensed landfill for industrial wastes from the mid 1960s until approximately 1971 when Rose Township brought a second law suit against the waste hauler and the land owner. The illegal disposal activities were conducted on approximately 12 acres of the upland portion of the Site. In 1979 the Michigan Department of Environmental Quality (MDEQ), formerly the Michigan Department of Natural Resources (MDNR), conducted a drum

survey on the property and identified approximately 1,500 drums on Site. A large number of these drums were severely deteriorated and had apparently released their contents. Based on this survey and the subsequent sampling of the identified drums, an interim remedial action was conducted by the MDEQ to remove the drums. By July 1980, more than 5,000 drums were identified and removed from the Site by the MDEQ.

Since 1980, the Site has been the subject of numerous investigations and remedial response activities, as summarized below:

- 1980 to 1982 – Initial Site investigation conducted by the MDEQ.
- 1982 – Site becomes part of the Federal Superfund program. A Remedial Investigation/Feasibility Study (RI/FS) is initiated.
- 1986 – The MDEQ conducts additional groundwater delineation activities.
- 1987 – Cleanup plan selected. Record of Decision (ROD) issued requiring Incineration of polychlorinated biphenyl (PCB) contaminated soil and extraction and treatment of contaminated groundwater with discharge to wetlands.
- 1989 - ROD Amendment #1 - Soil Flushing is added to the ROD as a soil remedy.
- 1992-1993 – Incineration of 50,000 cubic yards of PCB contaminated soil.
- 1995 – ROD Amendment #2 – Soil vapor extraction (SVE) chosen for remaining contaminated soils. Target cleanup levels (TCLs) for volatile organic compounds (VOCs) in soil were also amended.
- 1995 – 1996 – Both SVE and groundwater extraction/treatment systems designed and constructed.
- 1997 – Earth Tech is subcontracted for the operation, maintenance, and monitoring (OM&M) of the Site.
- 2002 – Dissolved vinyl chloride concentrations detected beyond the groundwater system capture zone.
- 2004 – Dissolved vinyl chloride concentrations detected at northeast boundary of the Site. Earth Tech begins off-Site delineation activities.
- 2005-2006 – Hydrologic Study conducted to determine the interaction between surface water and groundwater at the Site.
- 2006 – “Hot Spot” soils investigation conducted to evaluate if continuing sources for VOCs are still present in Site soils.

## 1.2 GEOLOGY/HYDROGEOLOGY

The Site is located on a glacial end-moraine and represents a local topographic high which serves as a local recharge area for the shallow aquifer. Site topography ranges from approximately 950 to 1,100 ft. AMSL. The surface water runoff from the Site drains to wetland areas that border the Site on the northeast and west.

The regional geology consists of approximately 250 to 300 feet of glacial drift underlain by bedrock comprised of the Mississippian-aged Coldwater Shale and Marshall Formation (sandstone unit). The glacial drift is composed of complex stratifications of clay tills, outwash deposits (sand and gravel), and ice contact deposits (silts and silty clays). Lacustrine deposits (silt and clay) are also common in the topographically lower lying flat areas and are gradational and interbedded with glacial outwash deposits.

The shallow Site geology consists of complex interbedded glacial deposits (silt to gravelly sands) underlain by clay till that appears to be laterally continuous across the Site and surrounding area. This till layer is considered the base of the aquifer of interest at the Site. In the northeastern and western portions of the Site (the topographically lower areas comprised of wetlands) these water bearing silts and sands are overlain by interbedded lacustrine clays. These interbedded lacustrine clays produce semi-confining conditions for the aquifer causing wells in the lower elevation portions of the Site (areas below approximately 990 ft. AMSL) to flow under natural artesian pressure.

The Site is within an area of complex hydrogeology. The soil below the Site is composed of interbedded clay, silt, sand and gravel. The percentage of each material composing the aquifer affects the direction and velocity of groundwater flow, resulting in changes in the direction and nature of the dissolved contaminant plume. Groundwater flow is generally from south to north across the southern two thirds of the Site, toward well DNR-7 (Figure 2). This portion of the Site, located on a topographic high, acts as a local groundwater recharge area. North of well DNR-7, on the northern third of the property, there is a marked decrease in ground surface and aquifer elevation. Just north of this area the aquifer becomes artesian due to the presence of the interbedded lacustrine clays and a corresponding drop in topography. The aquifer pinches and thins out toward the north, which corresponds to a change in groundwater flow direction to the east-northeast towards the wetlands that are present on the northeastern portion of the Site.

### **1.3 STATUS OF GROUNDWATER INVESTIGATIONS**

A dissolved VOC plume has been detected in the water bearing zone beneath the Site. Trichloroethene (TCE) and its degradation products, cis-1,2-dichloroethene (cis-1,2-DCE) and vinyl chloride (VC), are the most prevalent VOCs in groundwater beneath the Site. TCE is

encountered mainly in wells on the south end of the Site near the existing building. VC has been observed in wells near the area of the on-Site building extending to, and possibly beyond, the northeast property boundary. To monitor the groundwater plume at the Site, 35 monitoring wells are sampled quarterly with an additional 21 wells sampled on an annual basis.

The potential for off-Site groundwater contamination was considered based on the observed VC concentrations in groundwater at the Site property boundary, and the detection of low concentrations of VC in a residential supply well at 510 Demode Road. The residents of this home utilize bottled water for drinking, a treatment system has been installed for the home, and the well is monitored on a monthly basis. Since it was first monitored in 2003, VC concentrations in the well at 510 Demode Road have ranged from 0.4 µg/L to 4.9µg/L. In December 2006, the VC concentration was 3.9ug/L.

To investigate whether this VC originates at the Site, eight monitoring wells, including GW-22S, GW-22I, GW-22D, GW-23S, GW-23I, GW-23D, GW-24I, and GW-24D were installed off-Site on the opposite side of the wetlands east of the Site (Figure 1). These off-Site wells are sampled quarterly and to date have shown no detectable levels of dissolved VOCs.

To fill possible data gaps and further refine the understanding of the Site hydrogeology and VOC contaminant migration mechanisms, four additional off-Site monitoring wells, MW-25I, MW-25D, MW-26I and MW-26D were installed in April 2006 (Figure 1). With the exception of a low concentration of toluene in GW-26D (1.1 µg/L) in the sample from June 2006 and a 7.9 µg/L concentration of carbon disulfide in December 2006, VOCs have not been detected in these wells.

Between December 12 and 22, 2006, nineteen soil borings were drilled and sampled as part of a soils "hot spot" investigation. The purpose of this investigation was to evaluate soil conditions within selected areas at the site that may potentially be continuing sources or "hot spots" for VOCs in groundwater. During the drilling activities, investigative groundwater samples were also collected from each boring, using a temporary well point and low flow sampling techniques. Reporting for the hot spot investigation is currently in progress. However, the groundwater analytical results obtained during hot spot investigation are discussed in this document.

## **2.0 FIELD AND ANALYTICAL METHODS**

Groundwater gauging and sampling activities were performed at the Site between December 11 and 14, 2006. With the exception of the natural flowing artesian wells, the groundwater monitoring wells were purged and sampled using low-flow minimal draw-down techniques. The artesian wells were purged using the natural flow-pressures at the wellhead. The field practices and procedures used for the groundwater monitoring wells during the December 2006 quarterly groundwater monitoring event were consistent with those established during previous monitoring events. Seventeen of the 37 wells sampled this quarter were purged using a peristaltic pump and dedicated tubing. Four of the 37 wells were sampled using a bladder pump and dedicated tubing. DNR-6 was also purged with a bladder pump but did not recover sufficiently to be sampled. Eleven wells were purged and sampled using natural artesian flow. Five active recovery wells were also sampled. A brief description of the groundwater gauging, sampling, and analyses are provided below.

### **2.1 GROUNDWATER ELEVATIONS**

On December 15, 2006, Earth Tech collected static groundwater level measurements from 110 monitoring wells located both on-Site and off-Site (Table 1 and Figure 2). The groundwater levels from the flowing artesian wells were measured using a sealed k-packer wellhead assembly with a pressure transducer capable of reading water levels to an accuracy of 0.01 feet. Prior to gauging the wells, the transducer was calibrated and any difference in vertical distance from the calibration point to the water surface was noted and recorded so that the readings could be corrected later, if necessary. The device was set on top of each well casing and the pressure head was allowed to stabilize before it was recorded in units of feet of water above the top of the well casing (ATOC). The water levels from the stainless steel monitoring wells (GW-1S, GW-2, GW-3S, GW-4S, and GW-6S) were measured using a separate k-packer assembly designed to seal their larger inside diameter.

The groundwater levels from the non-flowing wells were measured to within 0.01 feet, using an electronic water level indicator. The distance from the top of the well casing to the groundwater potentiometric surface in the well was measured and recorded as the static water level (SWL).

The groundwater level elevations were calculated by subtracting the SWL from the TOC elevation. The water level indicator was decontaminated prior to each use. The active extraction wells, PW-1, PW-3, PW-7, and PW-8, were not gauged as the water levels in these wells are not representative of static groundwater elevations. Groundwater levels from inactive extraction well PW-5 and active extraction wells, PW-4 and PW-6, were also not measured as these wells are under uncontrollable artesian conditions.

## **2.2 GROUNDWATER SAMPLING PROCEDURES**

Groundwater sampling was conducted between December 11 and 14, 2006. Details summarizing the sampling procedures for the low-flow pumping method and natural artesian flow methods are provided in the following sections. All purge water was disposed through the on-Site groundwater remediation treatment system.

### **2.2.1 LOW-FLOW SAMPLING METHODS**

A total of 21 groundwater monitoring wells were purged using low-flow methods, utilizing either a peristaltic pump (17 wells) or a bladder pump (4 wells), at flow rates ranging from 100 to 500 milliliters per minute. DNR-6 was also purged with a bladder pump but did not recover sufficiently to be sampled. During the installation of the tubing for the peristaltic pump or the placement of the bladder pump, care was taken to minimize disturbance of the stagnant water column in the well. If a bladder pump was used to purge the well, the pump was installed in the well and left in place for at least one hour to equilibrate with the water column before purging commenced.

Field parameters, including pH, temperature, conductivity, dissolved oxygen, oxidation reduction potential (ORP), salinity, and turbidity, were collected and recorded throughout purging activities. With the exception of turbidity, field parameter readings were measured in-line using a sealed flow-through cell and multi-parameter analyzer. Turbidity readings were obtained using an extracted water sample and a separate optical turbidity meter. Groundwater purging continued until the pH, temperature, and conductivity parameters were observed within  $\pm 10$  percent of the average of three measurements taken five minutes apart. Once the groundwater

quality parameters stabilized, the tubing was removed from the flow-through cell and the sample collected directly from the discharge line of the peristaltic or bladder pump. The discharge flow rate was decreased, as necessary, to maintain laminar flow while filling the sample bottles.

### **2.2.2 NATURAL ARTESIAN FLOW SAMPLING METHODS**

A total of 11 monitoring wells were purged using natural artesian flow. The flowing artesian wells were sampled using a sealed k-packer wellhead assembly with a small diameter hose barb at the other end. A short section of hose attached this assembly to a flow diversion valve which controlled the amount of water flowing into the flow-through cell. The water flow into the cell was only reduced far enough not to damage the flow through cell. Field parameters were collected and recorded throughout purging activities, as described above for the low-flow sampling method.

### **2.2.3 ACTIVE GROUNDWATER EXTRACTION WELL SAMPLING METHODS**

Two active groundwater extraction wells were sampled during the December 2006 quarterly sampling event. These well samples were collected through sample collection ports built into the piping between the groundwater treatment system and each well. Field parameters, including pH, temperature, conductivity, dissolved oxygen, ORP, salinity, and turbidity, were collected and recorded prior to the collection of the analytical sample.

## **2.3 ANALYTICAL METHODS**

Groundwater samples were collected at 32 monitoring well locations and five active pumping wells. Well sampled this event include DNR-1, DNR-4D, DNR-7, GW-4D, GW-5I, GW-6D, GW-17I, GW-17D, GW-18, GW-19S, GW-19D, GW-20D, GW-20I, GW-21S, GW-21D, GW-22S, GW-22I, GW-22D, GW-23S, GW-23I, GW-23D, GW-24I, GW-24D, GW-25I, GW-25D, GW-26I, GW-26D, MW-3I, MW-102D, MW-103S, RW-1D, and RW-5S. PW-1, PW-4, PW-6, PW-7, PW-8. All samples were analyzed by Trimatrix Laboratories, of Grand Rapids, Michigan, for the following parameters:

- Volatile Organic Compounds (VOCs) by United States Environmental Protection Agency (USEPA) Method 8260B



- Biogeochemical Parameters:
  - Dissolved gases (methane, ethane, ethene) by RSK 175
  - Inorganics (ammonia, nitrate/nitrite, sulfate, chloride) by USEPA 300 Series Methods
  - Total organic carbon (TOC), and alkalinity (total) by USEPA Series 300 and 400 Methods

In addition to the laboratory analytical methods listed above, groundwater from each well was measured in the field for sulfide and dissolved metals (iron and manganese). These field measurements were obtained using colorimetric methods with a Hach DR 850 instrument, after the well was purged and the field parameters had stabilized.

## 2.4 QUALITY ASSURANCE/QUALITY CONTROL SAMPLES

Quality assurance quality control (QA/QC) samples were collected to monitor the effectiveness of the decontamination procedures and to identify any field or laboratory conditions that may affect sample integrity. QA/QC samples included the following:

- **Duplicate Samples** - Duplicate samples were collected from four monitoring wells. The wells selected for duplicate sample collection were DNR-1, GW-19S, GW-22S, and GW-26I. For each sample obtained, a duplicate set of sample containers were filled immediately following collection of the original sample. Each duplicate sample was handled and analyzed in a fashion identical to the monitoring well samples.
- **Rinsate Samples** - Three rinsate (equipment blank) samples were collected following standard decontamination procedures. Equipment blank samples were collected at a frequency of one sample per day when non-dedicated equipment was being used. For each equipment blank sample, deionized water was poured through the decontaminated sampling equipment and collected in a set of sample containers. Each equipment blank sample was handled and analyzed in a fashion identical to the monitoring well samples.
- **Matrix Spike/Matrix Spike Duplicates (MS/MSD)** - MS/MSD samples were collected from two monitoring wells. The wells selected for MS/MSD sample collection included GW-20D and RW-5S. For each sample, one additional set of sample containers was filled immediately following the collection of the corresponding original sample and submitted for laboratory QA/QC purposes. Each MS/MSD sample was handled and analyzed in a fashion identical to the monitoring well samples.
- **Field Blank Samples** - Two field blank samples were collected during the sampling event. Field blank samples were collected at a frequency of one for every two days of sampling. Field blank samples were collected by filling a set of VOC bottles with

laboratory de-ionized water and leaving the caps off the bottle while conducting the sampling at a monitoring well. Field blank samples were collected during the sampling of wells DNR-6 GW-23D, and GW-6D.

- **Trip Blank Samples** - One laboratory-prepared trip blank sample was transported with each cooler containing more than one groundwater sample submitted for VOC analysis. The trip blank sample was only analyzed for VOCs.

All QA/QC and monitoring well samples were placed directly into appropriately preserved sample containers, as prepared and provided by the analytical laboratory. All sample bottles were labeled, packed in coolers, and transported to the analytical laboratory under proper chain-of-custody procedures.

### **3.0 GROUNDWATER MONITORING RESULTS**

A total of 32 groundwater monitoring wells and five active pumping wells were purged and sampled during the December 2006 Quarterly groundwater monitoring event. All samples were analyzed for VOCs and biogeochemical indicator parameters. A total of 15 QA/QC samples including equipment blanks, field blanks, duplicates, MS/MSDs, and trip blanks were also collected.

VC, TCE, and cis-1,2-DCE are the primary VOCs at the Site based on the detected concentrations and frequency of detections in groundwater. The concentrations of these and other VOCs detected during the December monitoring event are summarized in Table 2. A summary of historically detected VOCs is provided as Table 3. The analytical results are summarized in the following sections.

#### **3.1 GROUNDWATER ELEVATIONS**

Water levels were measured in 110 groundwater monitoring wells on December 15, 2006. These water level data are summarized in Table 1.

Groundwater elevations decreased an average of 0.20 feet across the Site since the last monitoring event in September 2006. The groundwater level elevations ranged from 1,014.09 ft. AMSL at well RW-10, located in the central portion of the property, to 980.50 feet AMSL at monitoring well GW-6I, located off-Site and east of the northeast corner of the Site. The groundwater flow direction on-Site is generally from south to north at a horizontal gradient of approximately 0.001 feet/foot (ft/ft) across the southern and central portions of the property. The groundwater flow direction becomes more northeasterly near the northern property boundary (near wells DNR-6 and GW-10) and a strong easterly component becomes apparent between well cluster MW-102 and well cluster GW-19 (Figure 2). The groundwater gradient increases to approximately 0.005 ft/ft between these two well clusters.

### 3.2 FIELD PARAMETERS

Groundwater field parameters monitored during well purging activities included temperature, pH, conductivity, dissolved oxygen, turbidity, and ORP. When these parameters stabilize, the purge water is then considered to be representative of groundwater conditions within the water-bearing unit. A general discussion and summary of the stabilization parameters recorded during purging is provided below.

- **Temperature:** Groundwater temperatures ranged from 8.57 (GW-24D) to 10.84 (PW-8) °C.
- **pH:** Groundwater pH ranged from 5.89 (PW-8) to 9.71 (GW-26D).
- **Conductivity:** Groundwater conductivities ranged from 268 (DNR-6) to 650 (RW-5S) micro siemens per centimeter (µS/cm).
- **Dissolved Oxygen:** Dissolved oxygen values ranged from 0.07 (GW-6D) to 8.32 (PW-4) mg/L.
- **Turbidity:** Groundwater turbidity ranged from less than 0.0 (PW-1, PW-4, and PW-6) to 44.6 (MW-103S) nephelometric turbidity units (NTUs). Well DNR-6 had a turbidity reading of 251.0, however, this reading was collected just prior to the well going dry.
- **ORP:** Groundwater ORP ranged from -227 (GW-23D) to +7 (PW-1) millivolts (mV).

The field parameters recorded during the December 2006 annual sampling event are generally consistent with historical observations. The low dissolved oxygen and ORP values observed in most monitoring wells is indicative of ambient anaerobic conditions.

### 3.3 ANALYTICAL RESULTS

The VOC concentrations detected in December 2006 are summarized in Table 2. A table showing historical VOC concentrations is provided as Table 3.

The VOC analytical results are compared to the TCLs developed in the ROD (EPA, September 30, 1987). These TCLs are further subdivided into Phase I and Phase II TCLs as identified in the *Remedial Design and Remedial Action Work Plan* (Fred C. Hart Associates, Inc., et al, September 18, 1989). The detected VOC concentrations were also compared to the current

MDEQ Remediation and Redevelopment Division (MDEQ-RRD) Part 201 Generic Cleanup (Part 201) Residential Drinking Water, Groundwater Surface Water Interface (GSI), Groundwater Contact Criteria, as well as the 2004 Federal Drinking Water Maximum Contaminant Levels (MCLs).

In general, VOCs were detected in fifteen of the wells sampled in December 2006 (Table 2). VOCs were not detected in monitoring wells DNR-1, DNR-4D, GW-4D, GW-6D, GW-19D, GW-20I, GW-21S, GW-21D, GW-22S, GW-22I, GW-22D, GW-23S, GW-23I, GW-23D, GW-24I, GW-24D, GW-25I, GW-25D, GW-26I, and MW-102D. VOCs that were detected, but did not exceed the Part 201 Criteria, MCLs, or the ROD TCLs, include carbon disulfide, chlorobenzene, chloroethane, 1,1-dichloroethane, trans-1,2-dichloroethene, ethylbenzene, and 1,1,1-trichloroethane. The detected VOCs that exceeded one or more ROD TCL, Part 201, and/or MCL criterion are summarized below.

### 3.3.1 VINYL CHLORIDE

Vinyl chloride (VC) is the most prevalent VOC at the Site, detected in 15 of the 37 wells sampled during this monitoring event. The detected VC concentrations in groundwater well samples ranged from 1.2 µg/L (RW-5S) to 140 µg/L (GW-5I). This well data is consistent with previously observed groundwater monitoring well data, with the highest VC concentrations occurring in the northern (and downgradient) portion of the Site, near GW-5I and DNR-7, and the lowest concentrations occurring in the southeast portion of the Site, near PW-3 (Figure 4). However, groundwater samples collected during the December 2006 hot spot investigation showed elevated VC concentrations (660 µg/L to 810 µg/L) in the vicinity of well RW-4, indicating that the VC plume extends further south than previously thought (Figure 4). Monitoring well RW-4 was sampled during the hot spot investigation, but did not contain detectable VOCs. However, well RW-4 is screened more than 10-feet below the depth at which the sample was collected during the hot spot investigation. The detected VC groundwater data collected during the hot spot investigation have been included on Figure 4.

The VC concentrations detected in groundwater monitoring wells between April 2006 and December 2006 are summarized on the following table. A map showing the historical distribution of VC concentrations in monitoring wells across the Site is provided as Figure 5.

Recently, groundwater treatment system activity and/or inactivity has been considered when reviewing monitoring well concentration trends. For example, between the July and September 2005 sampling events, several wells showed either a sharp increase (RW-5S located near PW-3, GW-17I, and to a lesser extent GW-19S, located down gradient of the northernmost pumping wells PW-4 and PW-6) or decrease (GW-17D) in vinyl chloride concentrations. The groundwater treatment system was not operating for two months, between August 1 and October 1 2005, for maintenance of the air stripping tower. The concentration changes observed in the wells noted above may have been associated with the period of system inactivity. During the fourth quarter 2006, the groundwater treatment system was down for maintenance between October and November. However, no VOC concentration trends are directly attributed to the treatment system downtime during this reporting period. The system performance during this quarter is further discussed in Section 5.0.

ROD TCLs for Vinyl Chloride		2004 Federal Drinking Water MCL for Vinyl Chloride ( $\mu\text{g/L}$ )	Part 201 Criteria for Vinyl Chloride ( $\mu\text{g/L}$ )		
Phase I TCLs	Phase II TCLs		Residential Drinking	Groundwater Surface Water	Groundwater Contact Criteria
1	0.003	2	2	15	1,000
Well ID	Monitoring Event		Observed Vinyl Chloride Concentrations ( $\mu\text{g/L}$ )		
DNR-6	April 2006		30		
	June 2006		33		
	September 2006		35		
	December 2006		NS		
DNR-7	April 2006		120		
	June 2006		110		
	September 2006		95		
	December 2006		89		
GW-5I	April 2006		160		
	June 2006		140		
	September 2006		160		
	December 2006		140		

ROD TCLs for Vinyl Chloride		2004 Federal Drinking Water MCL for Vinyl Chloride (µg/L)	Part 201 Criteria for Vinyl Chloride (µg/L)		
Phase I TCLs	Phase II TCLs		Residential Drinking	Groundwater Surface Water	Groundwater Contact Criteria
1	0.003	2	2	15	1,000
Well ID	Monitoring Event		Observed Vinyl Chloride Concentrations (µg/L)		
GW-6D	April 2006		1.2		
	June 2006		ND		
	September 2006		ND		
	December 2006		ND		
GW-17I	April 2006		19		
	June 2006		9		
	September 2006		9.4		
	December 2006		9.0		
GW-17D	April 2006		20		
	June 2006		20		
	September 2006		21		
	December 2006		23		
GW-18	April 2006		38		
	June 2006		43		
	September 2006		13		
	December 2006		30		
GW-19S	April 2006		7.5		
	June 2006		5.6		
	September 2006		2.6		
	December 2006		2.3		
GW-20D	April 2006		26		
	June 2006		24		
	September 2006		20		
	December 2006		23		
MW-2I	June 2004		24		
	June 2005		21		
	June 2006		20		
MW-3I	April 2006		28		
	June 2006		28		
	September 2006		27		
	December 2006		28		

ROD TCLs for Vinyl Chloride		2004 Federal Drinking Water MCL for Vinyl Chloride ( $\mu\text{g/L}$ )	Part 201 Criteria for Vinyl Chloride ( $\mu\text{g/L}$ )		
Phase I TCLs	Phase II TCLs		Residential Drinking	Groundwater Surface Water	Groundwater Contact Criteria
1	0.003	2	2	15	1,000
Well ID	Monitoring Event		Observed Vinyl Chloride Concentrations ( $\mu\text{g/L}$ )		
PW-1	June 2005		31		
	June 2006		20		
	December 2006		16		
PW-4	June 2005		5.3		
	June 2006		3.7		
	December 2006		2.1		
PW-6	June 2005		71		
	June 2006		24		
	December 2006		29		
PW-7	April 2006		100		
	June 2006		45		
	September 2006		88		
	December 2006		80		
PW-8	April 2006		4.3		
	June 2006		2.4		
	September 2006		4.2		
	December 2006		4.8		
RW-1D	April 2006		ND		
	June 2006		ND		
	September 2006		ND		
	December 2006		1.5		
RW-5S	April 2006		1.7		
	June 2006		1.4		
	September 2006		1.1		
	December 2006		1.2		

Notes:

MCL = Maximum Contaminant Level

Shaded areas indicate that the concentration exceeds the MCL Part 201 or ROD Criteria.

Although VC concentrations over time vary between different individual monitoring wells, the general distribution of VC within the monitoring wells across the Site has remained relatively



consistent. Graphs showing detailed VC, TCE, and cis-1,2-DCE concentration trends over time (for wells with detectable concentrations of these VOCs) are provided as Figures 6 through 26.

Overall decreasing VC concentration trends are apparent in monitoring wells GW-5D, GW-6D, MW-3I, RW-5S, RW-5D, PW-1, PW-3, PW-6, PW-7, and PW-8. With the exception of RW-5S and RW-5D, these wells are all located in the vicinity of pumping wells PW-1, PW-4, and PW-6. RW-5S and RW-5D are located in the vicinity of pumping well PW-3.

Overall increasing VC concentration trends are seen in monitoring wells GW-18 and GW-20D, which are both located in the northeastern portion of the Site. Well GW-18 appears to have rebounded in December 2006, to concentrations more consistent with historical, after a distinct decrease in VC concentrations was observed between June and September 2006 (in September 2006 VC concentrations decreased from 43 µg/L to 13 µg/L). The VC concentration at wells DNR-6, DNR-7, GW-5I, GW-17I, GW-17D, GW-19S, MW-2I, and MW-103S are generally stable.

Table 3 and Figure 5 present historical VC data. To date, VC has not been observed in the off-Site well clusters GW-22I/S/D, GW-23I/S/D, GW-24I/D, GW-25I/D and GW-26I/D, located further down gradient. With the exception of low concentrations of carbon disulfide and toluene, VOCs have not been detected at these off-Site wells.

### 3.3.2 CIS-1,2-DICHLOROETHENE

Concentrations of cis-1,2-dichloroethene (cis-1,2-DCE) were detected in groundwater samples collected from four of the 32 wells sampled in December 2006. The cis-1,2-DCE concentrations ranged from 3.6 µg/L at well MW-103S to 170 µg/L at well DNR-7. The wells where cis-1,2-DCE was detected, and the reported concentrations, are provided in the table below. cis-1,2-DCE is typically observed in the north central portion of the site.

2004 Federal Drinking Water MCL for cis-1,2- DCE  ( $\mu\text{g/L}$ )	MDEQ Part 201 Residential Drinking Water Criteria for cis-1,2-DCE  ( $\mu\text{g/L}$ )	cis-1,2-DCE  Analytical Results ( $\mu\text{g/L}$ )  December 2006				
		DNR-7	MW-103S	PW-7	PW-8	RW-1D
70	70	170	3.6	47	ND	26

Notes:

MCL = Maximum Contaminant Level

Shaded areas indicate that the concentration exceeds the MCL Part 201 Criteria. No ROD TCLs were established for cis-1,2-DCE.

The concentrations of cis-1,2-DCE detected in monitoring wells this quarter are generally consistent with those previously observed. Elevated concentrations of cis-1,2-DCE (3,200  $\mu\text{g/L}$  to 5,900  $\mu\text{g/L}$ ) were also identified in the groundwater samples obtained from borings in the vicinity of RW-4 during the hot spot investigation work. These are the highest cis-1,2-DCE concentrations observed at the Site.

Graphs showing detailed VC, TCE, and cis-1,2-DCE concentration trends over time (for wells with detectable concentrations of these VOCs) are provided as Figures 6 through 28. Over the last several sampling events the cis-1,2-DCE concentrations, where detected, have remained generally stable with a few exceptions. Overall slight decreasing concentration trends are evident in wells RW-5S, GW-5D, PW-7 and PW-8 since 2004.

### 3.3.3 TRICHLOROETHENE

Trichloroethene (TCE) was detected in groundwater samples collected from two of the 32 wells sampled in December 2006. The detected concentrations ranged from 2.7  $\mu\text{g/L}$  at well PW-8 and 98  $\mu\text{g/L}$  at well RW-1D. The wells where TCE was detected, and the reported concentrations, are provided in the table below.

ROD TCLs for TCE		2004 Federal Drinking Water MCL for TCE (µg/L)	Part 201 Residential Drinking Water Criteria for TCE (µg/L)	TCE Analytical Results (µg/L)  December 2006	
Phase I TCLs (µg/L)	Phase II TCLs (µg/L)			RW-1D	PW-8
1.5	0.627	5	5	98	2.7

Notes:

MCL = Maximum Contaminant Level

Shaded areas indicate that the concentration exceeds the ROD, MCL, or Part 201 Criteria.

This well data is consistent with previously observed groundwater monitoring well data, with the highest TCE concentrations (in wells) occurring in the southern portion of the Site, at RW-1D and the lowest concentrations occurring at PW-8 (Figure 4). However, groundwater samples collected during the December 2006 hot spot investigation showed an elevated TCE concentration (1,600 µg/L at ET13) in the general vicinity of well RW-4, indicating that the TCE plume extends further south than previously thought, and at higher concentrations (Figure 4). Additionally, TCE was detected in groundwater at a boring location near the southern property boundary (ET-4), within an area not previously documented to contain TCE. The detected TCE groundwater data collected during the hot spot investigation have been included on Figure 4.

The TCE concentrations reported at the monitoring wells in December 2006 are generally consistent with those observed in recent sampling events. To date, the furthest down gradient location at which TCE has been routinely detected is at pumping well PW-8. TCE has not been observed at any of the newest down-gradient wells and boundary wells, including the GW-17, GW-18, GW-19, GW-20 and GW-21 series, or any of the off-Site monitoring wells. A map showing the historical distribution of TCE and VC concentrations across the Site is provided as Figure 5.

Graphs showing detailed VC, TCE, and cis-1,2-DCE concentration trends over time (for wells with detectable concentrations of these VOCs) are provided as figures 6 through 28. In the wells where TCE has historically been detected, overall decreasing trends are evident in monitoring wells RW-5S, and pumping well PW-8, while the TCE concentrations at RW-1D have remained relatively stable.

### **3.3.4 BENZENE AND OTHER AROMATIC HYDROCARBONS**

Benzene was detected in the groundwater sample collected from one of the 32 wells sampled. The detected concentration of benzene in PW-7 was 7.6 µg/L. Benzene is sporadically observed in monitoring wells near the central portion of the site. During the hot spot investigation, Benzene was detected in groundwater samples from several of the soil borings (ET-6, ET-8, ET-10, ET-13/13B, and ET-15) located in the northern portion of the Site. Benzene concentrations in these borings ranged from 8.8 µg/L (ET-15) to 43 µg/L (ET-8). An isoconcentration map for benzene was not prepared.

Other aromatic hydrocarbons (primarily toluene, ethylbenzene, total xylenes, and chlorobenzene) were observed in a significant number of groundwater samples collected during the hot spot investigation. The highest constituent concentration reported was xylenes at 50,000 µg/L at boring ET-1. These aromatic hydrocarbons are not typically detected in the groundwater monitoring wells, suggesting that biodegradation of these compounds is occurring at the Site.

### **3.3.5 BIOGEOCHEMICAL DATA**

Thirty-four of the 37 groundwater samples collected in December 2006 were analyzed for biodegradation indicators including methane, ethane, ethene, nitrate/nitrite, ammonia, chloride, sulfate, total alkalinity, and total organic carbon. Additional biogeochemical parameters were collected in the field from all wells, including dissolved oxygen, ORP, dissolved iron, dissolved manganese, and sulfide. These parameters are used to determine the aerobic/anaerobic condition of the aquifer. In general, electron acceptors progress from oxygen to nitrate, manganese, iron, sulfate and methane, with oxygen indicating the aerobic end of the scale and methane indicating the anaerobic end of the scale.

A summary of the December 2006 biogeochemical results is provided in Table 4. The dissolved metals analytical results are also provided in Table 4. A summary of the biogeochemical and metals results obtained during this sampling event is provided as follows:

#### **Field Measurements**

**Dissolved Oxygen:** Dissolved oxygen values ranged from 0.07 (GW-6D) to 8.32 (PW-4) mg/L (see Section 3.2).

**ORP:** Groundwater ORP ranged from -227 (GW-23D) to +7 (PW-1) millivolts (mV) (see Section 3.2).

**Sulfide:** Sulfide concentrations ranged from 0.00 mg/L (multiple wells) to 0.80 mg/L (GW-22D, GW-23D, and MW-3I).

**Dissolved Iron:** Dissolved iron concentrations ranged from 0.0 mg/L (multiple wells) to 3.30 mg/L (RW-5S).

**Dissolved Manganese:** Dissolved manganese concentration ranged from 0.0 mg/L (multiple wells) to 1.1 mg/L (MW-103S).

#### **Laboratory Results**

**Methane:** Methane was detected in 33 of 34 wells in which it was sampled for, at concentrations ranging from 1.8 µg/L (GW-19D) to 660 µg/L (MW-102D).

**Ethane:** Ethane was detected in one of the wells in which it was sampled for. Ethane was detected in GW-26D at a concentration of 8.2 µg/L.

**Ethene:** Ethene was detected in eight of the wells in which it was sampled for at concentrations ranging from 1.1 µg/L (GW-23I) to 10 µg/L (PW-7).

**Nitrate:** Nitrate was detected in two of the wells in which it was sampled for at concentrations of 0.054 mg/L at RW-5S and 0.31 mg/L at PW-8.

**Nitrite:** Nitrite was not detected in any of the wells sampled.

**Sulfate:** Sulfate was detected in 29 of the wells in which it was sampled for, at concentrations ranging from 7.1 (PW-7) to 29 mg/L (GW-19D).

**Ammonia:** Ammonia was detected in 25 of the wells in which it was sampled for at concentrations ranging from 0.050 mg/L (DNR-7) to 0.22 mg/L (DNR-1).

**Chloride:** Chloride concentrations ranged from 1.3 mg/L (GW-21D and GW-25I) to 13 mg/L (GW-22D, GW-26D, and PW-8).

**Total Alkalinity:** Total alkalinity concentrations ranged from 90 mg/L (GW-26D) to 380 mg/L (GW-21S).

**Total Organic Carbon:** Total organic carbon content ranged from below the reporting limit of 1.0 mg/L (RW-5S) to 22 mg/L (GW-26D).

Based on a review of these data, the aquifer appears to be under predominantly anaerobic conditions, although neither strongly anaerobic nor aerobic conditions are apparent. Weakly aerobic conditions, as indicated by the elevated DO and ORP levels are present in, GW-22D, GW-23S, GW-23D, and GW-26I. Elevated concentrations of methane in DNR-7, GW-17D, GW-20D, MW-102D, PW-7 and RW-1D suggest that methanogenesis (anaerobic degradation) may be occurring at these locations. The overall low values for ORP are more indicative of anaerobic conditions.

### 3.4 QA/QC RESULTS

Analytical results for the QA/QC samples collected during the December 2006 sampling event are summarized below.

#### Trip Blanks

Six trip blank samples were submitted to the lab for analysis of VOCs. All six samples contained no detectable concentration of any VOC. Therefore no data qualification is necessary based on trip blank samples. None of the six trip blank samples had elevated reporting limits (RLs).

### **Field Blanks**

Two field blank samples were submitted to the laboratory for analysis of VOCs. Both samples contained no detectable concentration of any VOC. Neither of the field blank samples had elevated reporting limits (RLs).

### **Equipment Blanks**

Three equipment blank samples were submitted to the laboratory for analysis of VOCs. None of the samples contained detectable concentrations of VOCs. None of the three equipment blank samples had elevated reporting limits (RLs).

### **Duplicate Samples**

Duplicate samples (GW19S/GW19R, GW23I/GW-23R, and GW26I/GW26R) were within a 50% relative percent difference (RPD) for field precision.

### **Laboratory Method Blanks**

All laboratory method blanks were non-detect for all VOCs. No samples were qualified because of method blanks.

### **Laboratory Control Samples**

The laboratory control sample (LCS) for batch 0609321 was lower than the laboratory control limit for cis-1,3-dichloropropane. The LCS or laboratory control sample duplicate (LCSD) for batch 0609321 exceeded the upper control limit for bromomethane, chloroethane, chloromethane and vinyl chloride. All four compounds were non-detect in the affected samples, therefore no affected data were qualified as a result of this exceedance. The LCS or LCSD for batch 0609366 exceeded the upper control limit for bromomethane, chloroethane, chloromethane and vinyl chloride. All four compounds were non-detect in the affected samples, therefore no affected data were qualified as a result of this exceedance.

### **MS/MSDs**

In one sample (GW-25D) the matrix spike and/or the matrix spike duplicate (MS/MSD) recoveries were outside of control limits. The non-spiked sample for GW-25D was qualified with an estimated flag for carbon tetrachloride, cis-1,3-dichloropropane, trans-1,3-dichloropropane,

dibromochloromethane, and tetrahydrofuran. However, none of the affected compounds were detected at concentrations above the method detection limit.

#### **Holding Times**

All groundwater samples were analyzed within the recommended holding times for each analysis.



#### **4.0 SUMMARY OF DECEMBER 2006 GROUNDWATER MONITORING EVENT**

Water levels were collected from a total of 110 groundwater monitoring wells on December 15, 2006. Purging and sampling activities were performed on 23 on-site and 12 off-site wells between December 11 and 14, 2006 following appropriate technical and quality control procedures. All groundwater samples were submitted to Trimatrix Laboratories for analysis. All samples were analyzed within recommended holding times following strict quality control procedures.

In December 2006, groundwater elevations decreased an average of 0.20 feet since the last monitoring event in September 2006. The groundwater flow direction on-Site is generally from south to north in the southern and central portions of the property. The groundwater flow direction becomes more northeasterly near the northern property boundary (near wells DNR-6 and GW-10) and a strong easterly component becomes apparent between well cluster MW-102 and well cluster GW-19 (Figure 2). The groundwater gradient increases to approximately 0.005 ft/ft between these two well clusters. Groundwater flow may extend eastward from the area near GW-19 toward off-Site wells near Demode Road; however, only toluene has been detected in any groundwater monitoring wells on the east side of the wetland, despite the low level occurrence of VC in one off-Site private supply well (510 Demode).

The distribution of dissolved VOCs in the groundwater monitoring wells is generally consistent with historical patterns except that samples collected during the December 2006 hot spot investigation showed elevated VOC concentrations indicating that the VOC plume extends further south than previously thought (Figure 4). Other aromatic hydrocarbons (primarily benzene, toluene, ethylbenzene, total xylenes, and chlorobenzene) were also observed in a significant number of groundwater samples collected during the hot spot investigation. These aromatic hydrocarbons are not typically detected in the groundwater monitoring wells, suggesting that biodegradation of these compounds is occurring at the Site. Overall, concentrations of TCE, cis-1,2-DCE, and VC are either stable or decreasing across the Site, with the exception of wells GW-18 and GW-20D, located near the northeastern property corner. VC concentrations in these wells continue to show an overall increasing trend.

## **5.0 GROUNDWATER EXTRACTION AND TREATMENT SYSTEM PERFORMANCE**

The groundwater extraction and treatment system consists of six extraction wells and an air stripping system that is designed to remove VOCs from groundwater. The current active extraction wells are PW-1, PW-3, PW-4, PW-6, PW-7, and PW-8. Periodic monitoring of the treated and untreated groundwater is conducted in accordance with the Michigan Department of Environmental Quality (MDEQ) Substantive Requirements Document for Surface Water Discharge (Permit No. MIU990014).

### **5.1 COMPLIANCE**

Table 5 provides a summary of the influent and effluent analyses, and weekly average air emission rates for the three-month period from October 1, 2006 through December 31, 2006. The weekly monitoring data indicates that the treatment system effluent was compliant with Section A.1 of the Substantive Requirements Document MIU990014.

Average hourly air emission rates from the groundwater treatment system for each weekly sampling period from the air stripper were calculated for the current reporting period (October 1, 2006 through December 31, 2006). The air emission rates for the air stripper system ranged from 0.0006 to 0.0048 pounds per hour (lbs/hr) during this reporting period (Table 5). The permitted allowable emissions for both the SVE and air stripper systems are 1.0 lbs/hr VOC.

### **5.2 SYSTEM MODIFICATIONS**

In an effort to increase groundwater capture by the groundwater pump and treat system, three existing pumps in extraction wells PW-1, PW-4 and PW-6 were replaced by new, larger, submersible pumps. The wells were fitted with the following new pumps:

- PW-1 and PW-6 – The existing submersible pump at each well was replaced with a Grundfos 150S150-8 6-inch pump with 460 volt, 3-phase motor. The new pumps are being operated at approximately 130 and 120 gallons per minute, respectively.

- PW-4 – The existing centrifugal pump was replaced with a submersible Grundfos 75S75-12 4-inch pump with 460 volt, 3-phase motor. The new pump is being operated at approximately 60 gallons per minute.

Electrical wiring and component upgrades were performed on PW-1, PW-4 and PW-6. Pumping wells PW-1, PW-3, PW-7 and PW-8 were brought online on November 16, 2006. Pumping wells PW-4 and PW-6 were brought online on November 21, 2006, following repair of some minor pipe leaks within the well vaults. Capture zone monitoring is being currently conducted to assess the performance of the pump and treat system upgrades. As a part of monitoring, water levels from nearby wells have been collected for a period of one (1) month and groundwater samples are continuing to be collected monthly from wells PW-1, PW-4 and PW-6 for a period of three months to evaluate concentration changes. The system modification and capture zone monitoring program is summarized in the agency-approved July 21, 2006 Technical Memorandum entitled, *Extraction Well Pumping Rate Increase and Capture Zone Analysis, Rose Township Demode Road Superfund Site, Holly, Michigan* (Earth Tech, July 2006). The capture zone monitoring work is expected to be completed on March 2007. The results of the capture zone monitoring will be presented under separate cover.

### 5.3 SYSTEM OPERATIONS

The system has removed an estimated 441.20 lbs of VOCs from the groundwater to date since start-up of the groundwater collection and treatment system on February 10, 1996. This quarter, the groundwater treatment system removed 7.20 lbs of VOCs (1.6% of cumulative removal). This corresponds to an average VOC removal rate of 0.0034 lbs/hr for this quarter.

Table 6 provides the total volume of groundwater extracted from the active extraction wells, and percentage of pump operation per month for the period of October 1, 2006 through December 31, 2006. The following problems were encountered during this reporting period, which caused down time for the extraction wells:

- The groundwater treatment system was shut down for annual air stripper cleaning from October 9-12, 2006. The system was then operational from October 13-15, 2006.

- As a part of pump and treat system modifications, new larger submersible pumps were installed in PW-1, PW-4 and PW-6 in an effort to increase capture. Due to issues with system electrical wiring and components for these wells, the system was not operational between October 16 and November 16, 2006.
- Electrical wiring and component upgrades were performed on PW-1, PW-4, and PW-6. Pumping wells PW-1, PW-3, PW-7 and PW-8 were brought online on November 16, 2006.
- The groundwater treatment system was down from November 18 through November 20, 2006. PW-3 was offline from November 21 to 27, 2006.
- Pumping wells PW-4 and PW-6 were brought online on November 21, 2006, following repair of some minor leaks within the well vaults.
- Pumping well PW-4 went offline on two occasions on November 21, 2006 and December 20, 2006. These offline occurrences happened due to tripping of the thermal overload at the motor control panel. The overload was reset and PW-4 was brought back online on November 22, 2006 and December 21, 2006 respectively.

The groundwater pump and treat system operated an average of greater than 95% over the quarter for all wells except PW-4. PW-4 operated an average of 50% during the quarter. Earth Tech will continue to track changes in contaminant concentrations in the wells and attempt to correlate this data with system operation. Earth Tech endeavors to keep system downtime to a minimum.

## **6.0 PLANNED PROJECT ACTIVITIES**

The next two quarterly groundwater sampling events are planned to take place in March and June 2007. Cleaning of selected pumping wells is tentatively scheduled for spring 2007.



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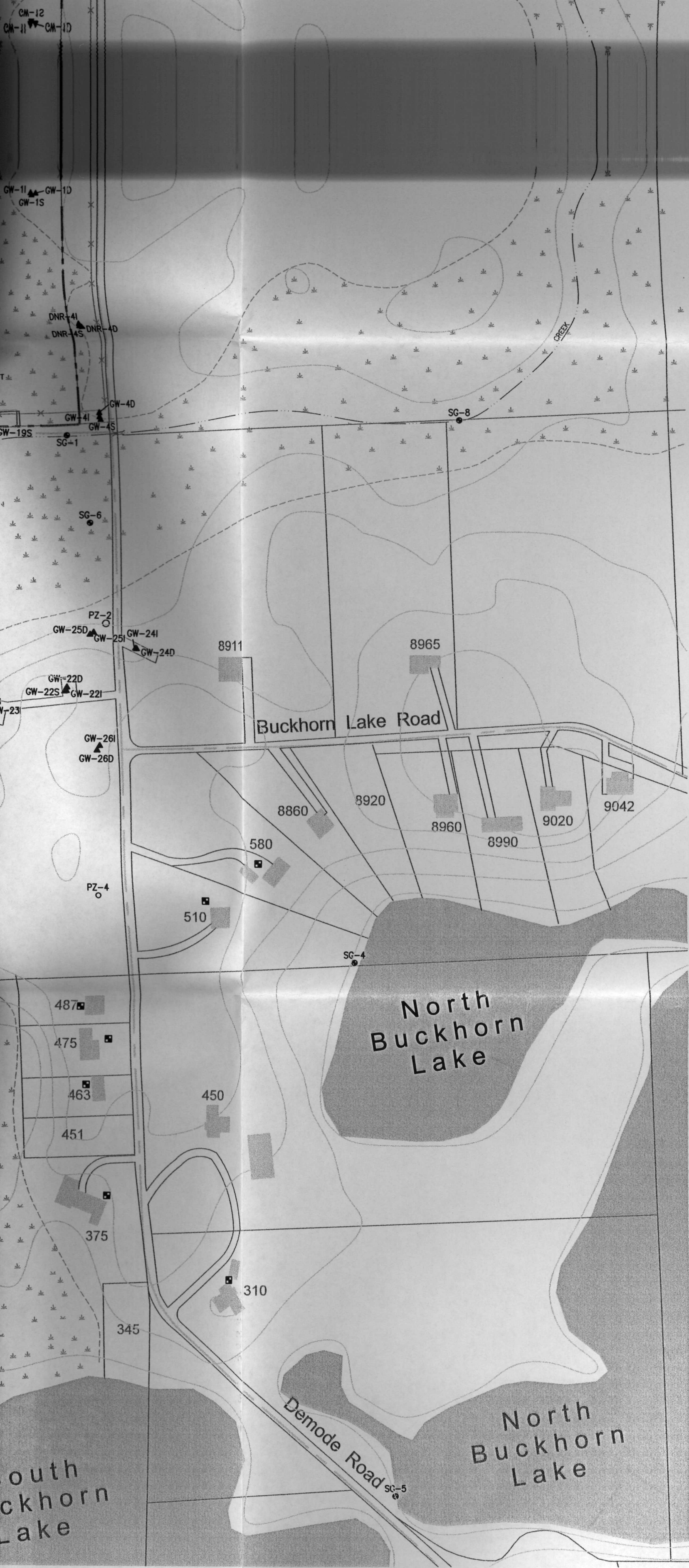
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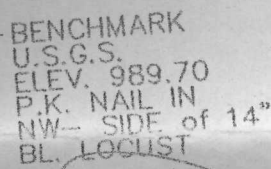
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Rose Township Demode Road Holly, Michigan				Figure 1 Site Map and Well Locations			
DATE		7/06					
PROJECT NO		89861					
FILENAME		89861New Base Map 5-06.dwg					
SHEET NO		1 of 26					
DRAWING NO		1					





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					DRN	DES		CHK
Rose Township Demode Road Holly, Michigan					Copyright© EARTH TECH, Inc., All Rights Reserved			NO
Figure 2 Groundwater Level Elevation Contours December 2006					DATE			03/07
					PROJECT NO			96362.04
2					FILENAME			96362_Q4_2006_Fig2
					SHEET NO			2 of 26
510					DRAWING NO			

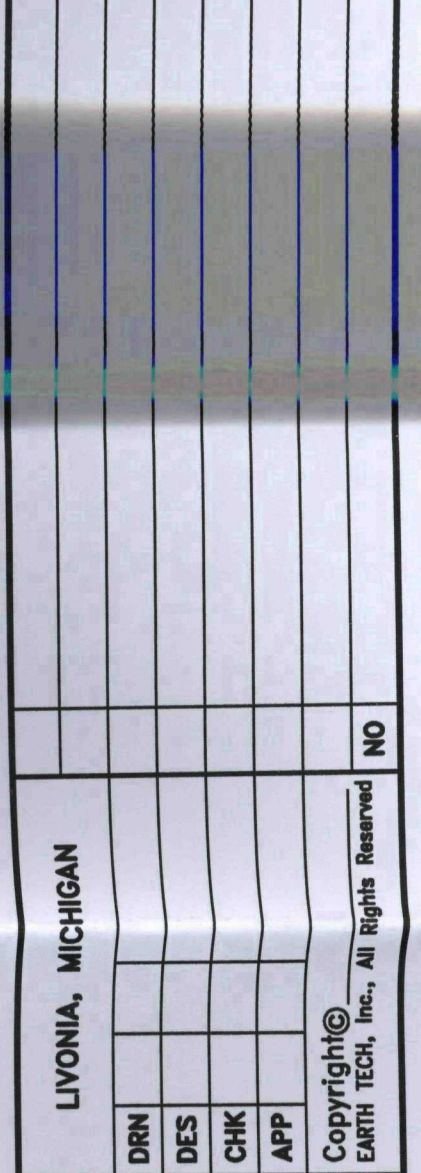




GW-19S	
Parameter	ug/L
Vinyl Chloride	2.3

<b>DATE</b>	1/07
<b>PROJECT NO</b>	89861.02.04
<b>FILENAME</b>	89861_Q4_2006_Fig3.dwg
<b>SHEET NO</b>	3 of 26
<b>DRAWING NO</b>	3



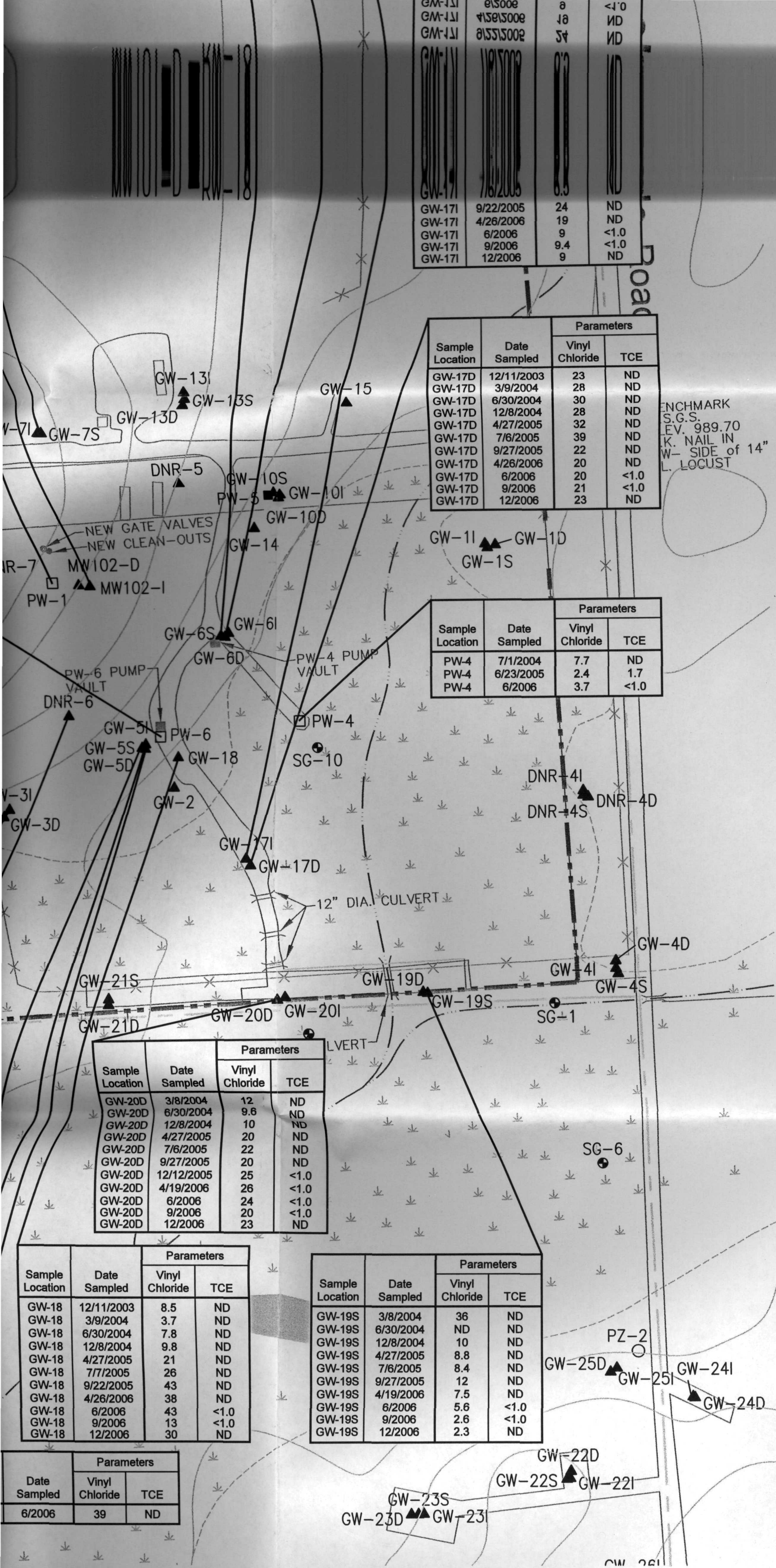


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**Figure 4**  
**TCE and Vinyl Chloride Isoconcentration Map**  
**December 2006**

DATE	1/07
PROJECT NO	96362
FILENAME	96362_Q4_2006_Fig4.dwg
SHEET NO	4 of 26
DRAWING NO	4





Sample Location	Date Sampled	Parameters	
		Vinyl Chloride	TCE
GW-17I	9/22/2005	24	ND
GW-17I	4/26/2006	19	ND
GW-17I	6/2006	9	<1.0
GW-17I	9/2006	9.4	<1.0
GW-17I	12/2006	9	ND

Sample Location	Date Sampled	Parameters	
		Vinyl Chloride	TCE
GW-17D	12/11/2003	23	ND
GW-17D	3/9/2004	28	ND
GW-17D	6/30/2004	30	ND
GW-17D	12/8/2004	28	ND
GW-17D	4/27/2005	32	ND
GW-17D	7/6/2005	39	ND
GW-17D	9/27/2005	22	ND
GW-17D	4/26/2006	20	ND
GW-17D	6/2006	20	<1.0
GW-17D	9/2006	21	<1.0
GW-17D	12/2006	23	ND

Sample Location	Date Sampled	Parameters	
		Vinyl Chloride	TCE
PW-4	7/1/2004	7.7	ND
PW-4	6/23/2005	2.4	1.7
PW-4	6/2006	3.7	<1.0

Sample Location	Date Sampled	Parameters	
		Vinyl Chloride	TCE
GW-20D	3/8/2004	12	ND
GW-20D	6/30/2004	9.6	ND
GW-20D	12/8/2004	10	ND
GW-20D	4/27/2005	20	ND
GW-20D	7/6/2005	22	ND
GW-20D	9/27/2005	20	ND
GW-20D	12/12/2005	25	<1.0
GW-20D	4/19/2006	26	<1.0
GW-20D	6/2006	24	<1.0
GW-20D	9/2006	20	<1.0
GW-20D	12/2006	23	ND

Sample Location	Date Sampled	Parameters	
		Vinyl Chloride	TCE
GW-18	12/11/2003	8.5	ND
GW-18	3/9/2004	3.7	ND
GW-18	6/30/2004	7.8	ND
GW-18	12/8/2004	9.8	ND
GW-18	4/27/2005	21	ND
GW-18	7/7/2005	26	ND
GW-18	9/22/2005	43	ND
GW-18	4/26/2006	38	ND
GW-18	6/2006	43	<1.0
GW-18	9/2006	13	<1.0
GW-18	12/2006	30	ND

Sample Location	Date Sampled	Parameters	
		Vinyl Chloride	TCE
GW-19S	3/8/2004	36	ND
GW-19S	6/30/2004	ND	ND
GW-19S	12/8/2004	10	ND
GW-19S	4/27/2005	8.8	ND
GW-19S	7/6/2005	8.4	ND
GW-19S	9/27/2005	12	ND
GW-19S	4/19/2006	7.5	ND
GW-19S	6/2006	5.6	<1.0
GW-19S	9/2006	2.6	<1.0
GW-19S	12/2006	2.3	ND

Date Sampled	Parameters	
	Vinyl Chloride	TCE
6/2006	39	ND

Parameters	
Vinyl Chloride	TCE
150	ND
170	ND
94	ND
210	ND
230	ND
180	ND
220	ND
180	ND
200	<1.0
160	<1.0
140	<1.0
140	ND

**Note:**  
1. All concentrations are in µg/L.

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Rose Township Demode Road  
Holly, Michigan

Figure 5  
Summary of Historical TCE and  
VC Concentrations

DATE11/06

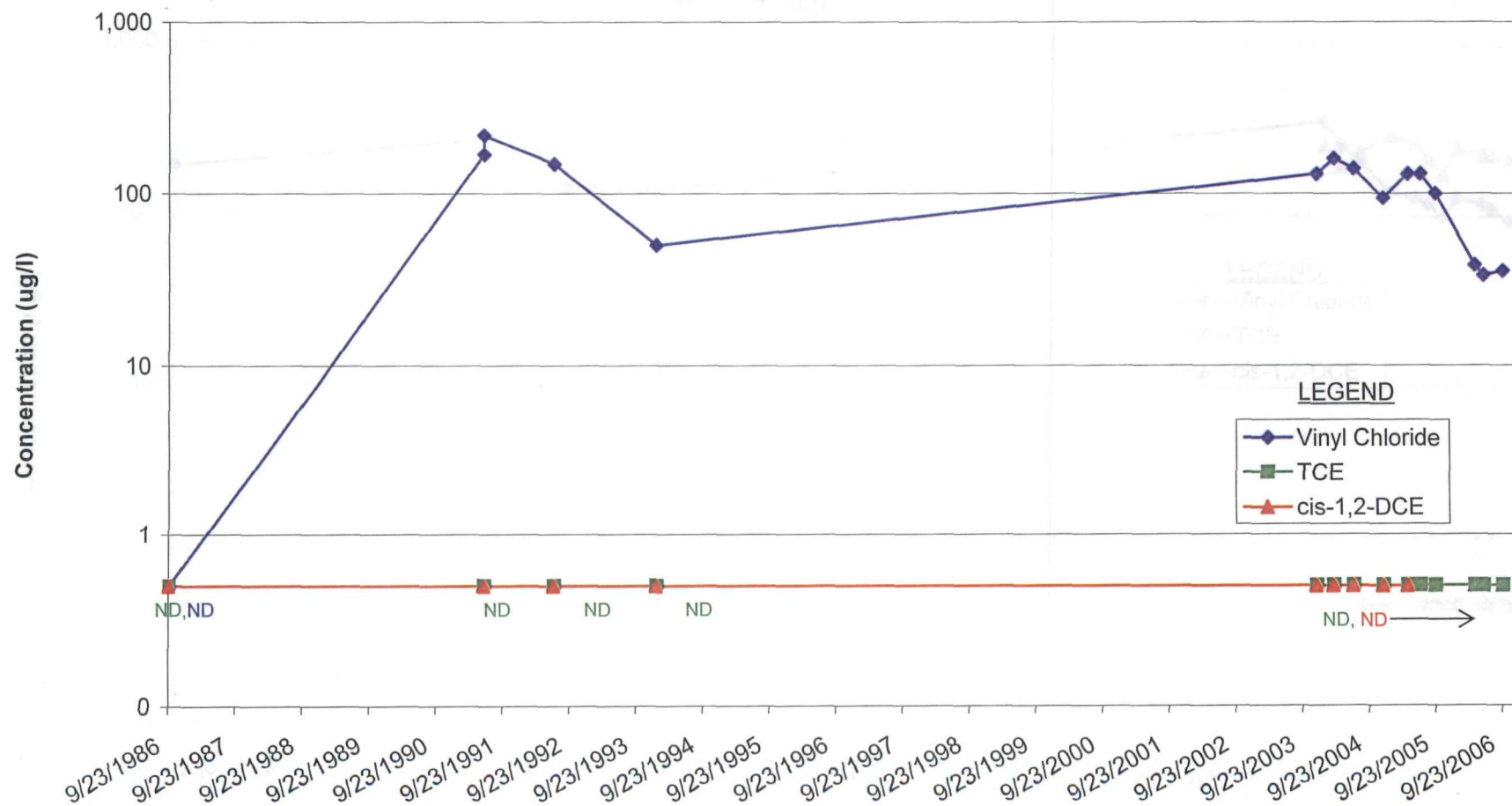
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FILENAME89861\_Q3\_2006\_Fig5.dwg

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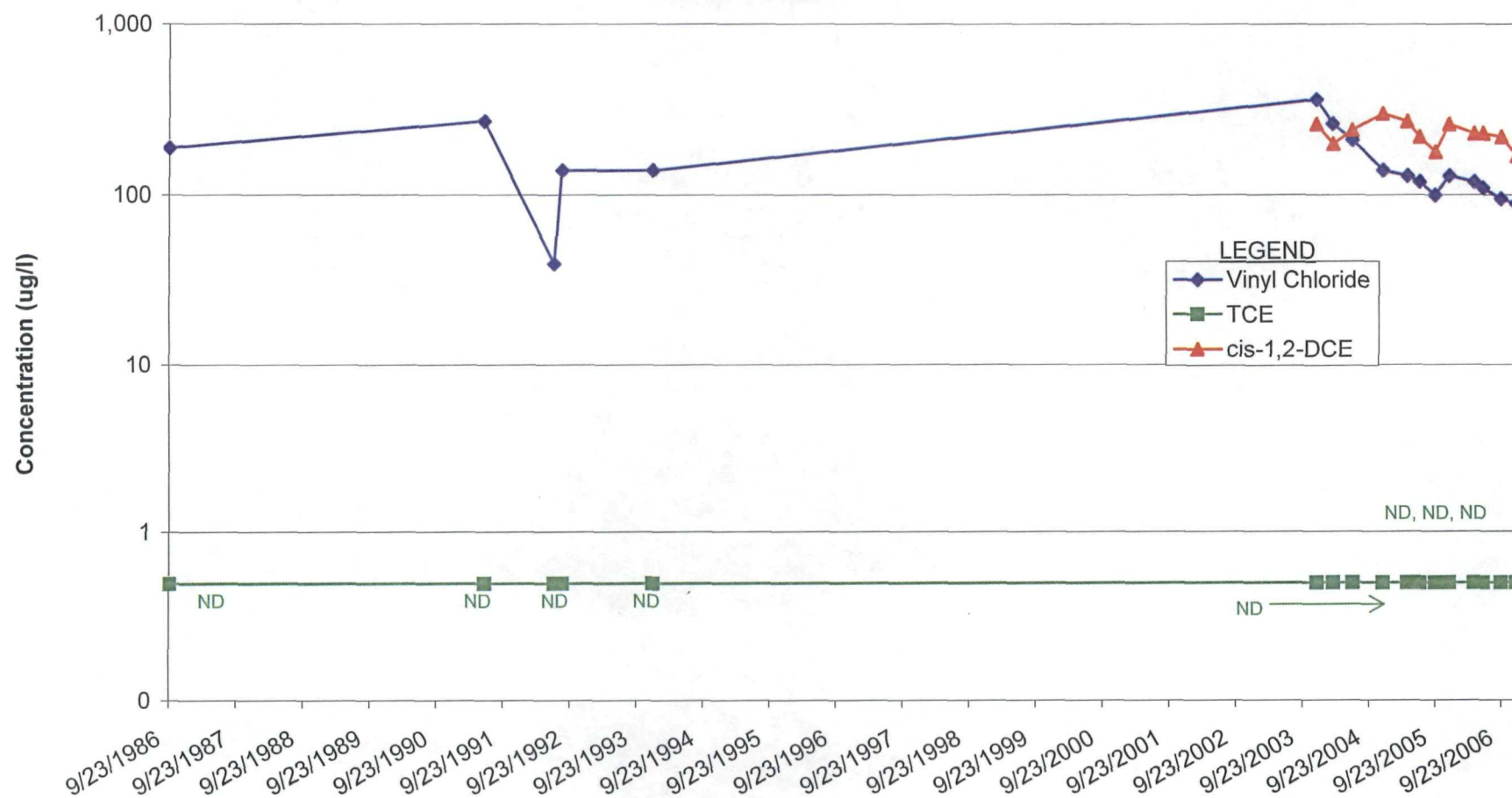
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**FIGURE 6**  
**DNR-6**  
**VC, TCE, and cis-1,2-DCE Concentrations Over Time**  
**December 2006 Quarterly Monitoring Event**  
**Rose Township Site**  
**Holly, Michigan**

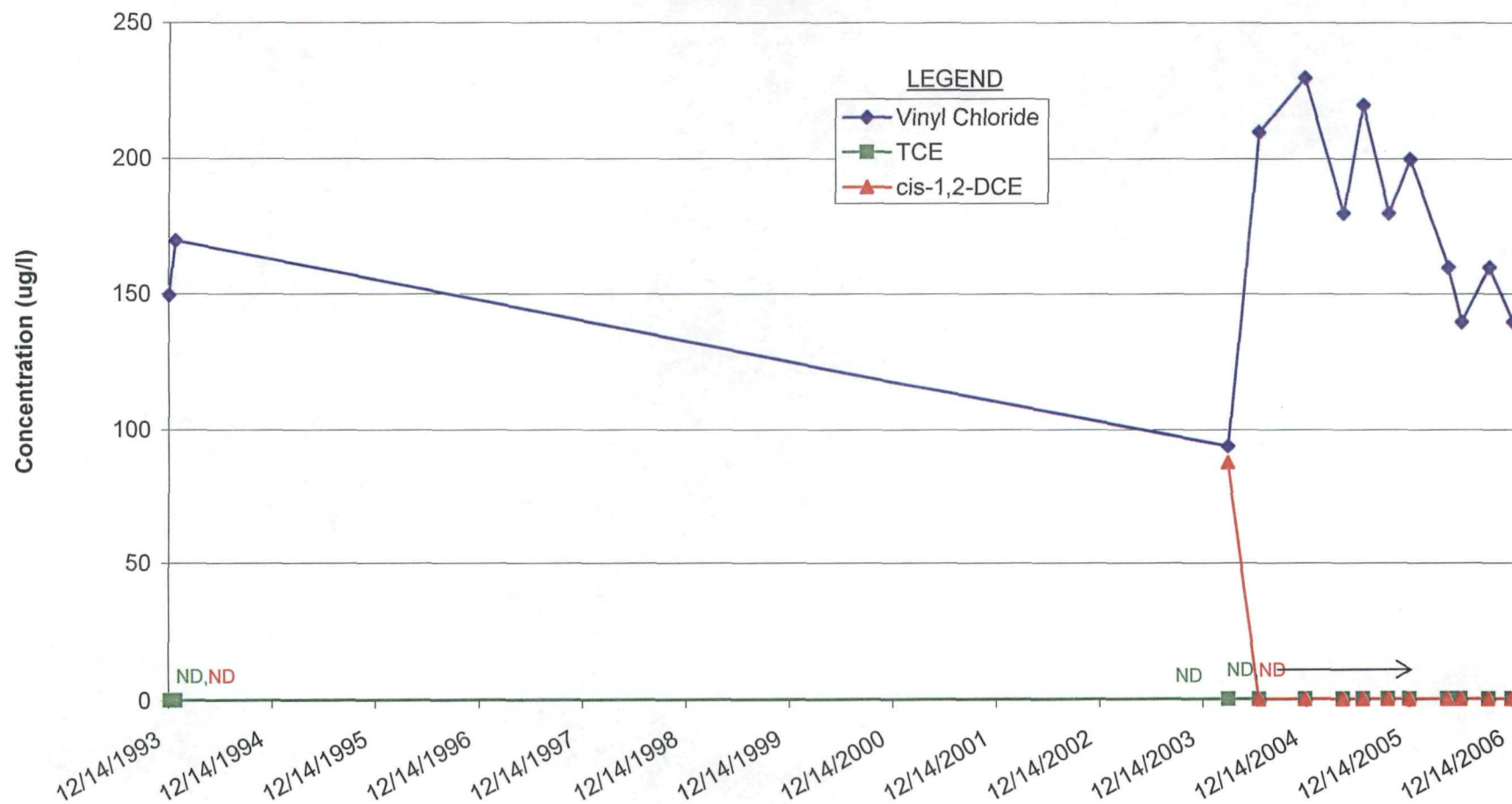




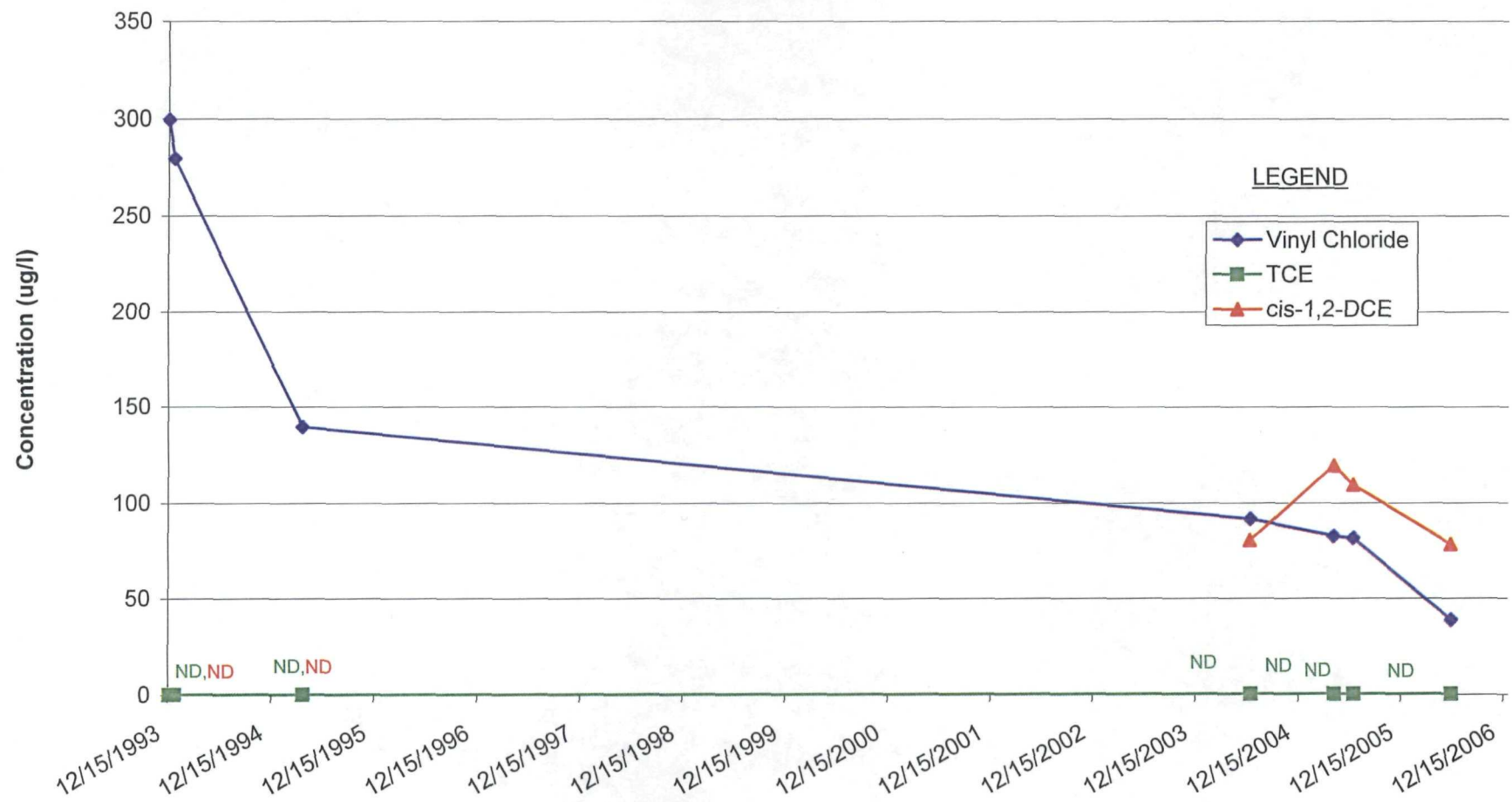
**FIGURE 7**  
**DNR-7**  
**VC, Tce, and cis-1,2-DCE Concentrations Over Time**  
**December 2006 Quarterly Monitoring Event**  
**Rose Township Site**  
**Holly, Michigan**



**FIGURE 8**  
**GW-5I**  
**VC, TCE, and cis-1,2-DCE Concentrations Over Time**  
**December 2006 Quarterly Monitoring Event**  
**Rose Township Site**  
**Holly, Michigan**



**FIGURE 9**  
**GW-5D**  
**VC, TCE, and cis-1,2-DCE Concentrations Over Time**  
**December 2006 Quarterly Monitoring Event**  
**Rose Township Site**  
**Holly, Michigan**





**FIGURE 10**  
**GW-6D**  
**VC, Tce, and cis-1,2-DCE Concentrations Over Time**  
**December 2006 Annual Monitoring Event**  
**Rose Township Site**  
**Holly, Michigan**



**FIGURE 11**  
**GW-17I**  
**VC, TCE, and cis-1,2-DCE Concentrations Over Time**  
**December 2006 Quarterly Monitoring Event**  
**Rose Township Site**  
**Holly, Michigan**

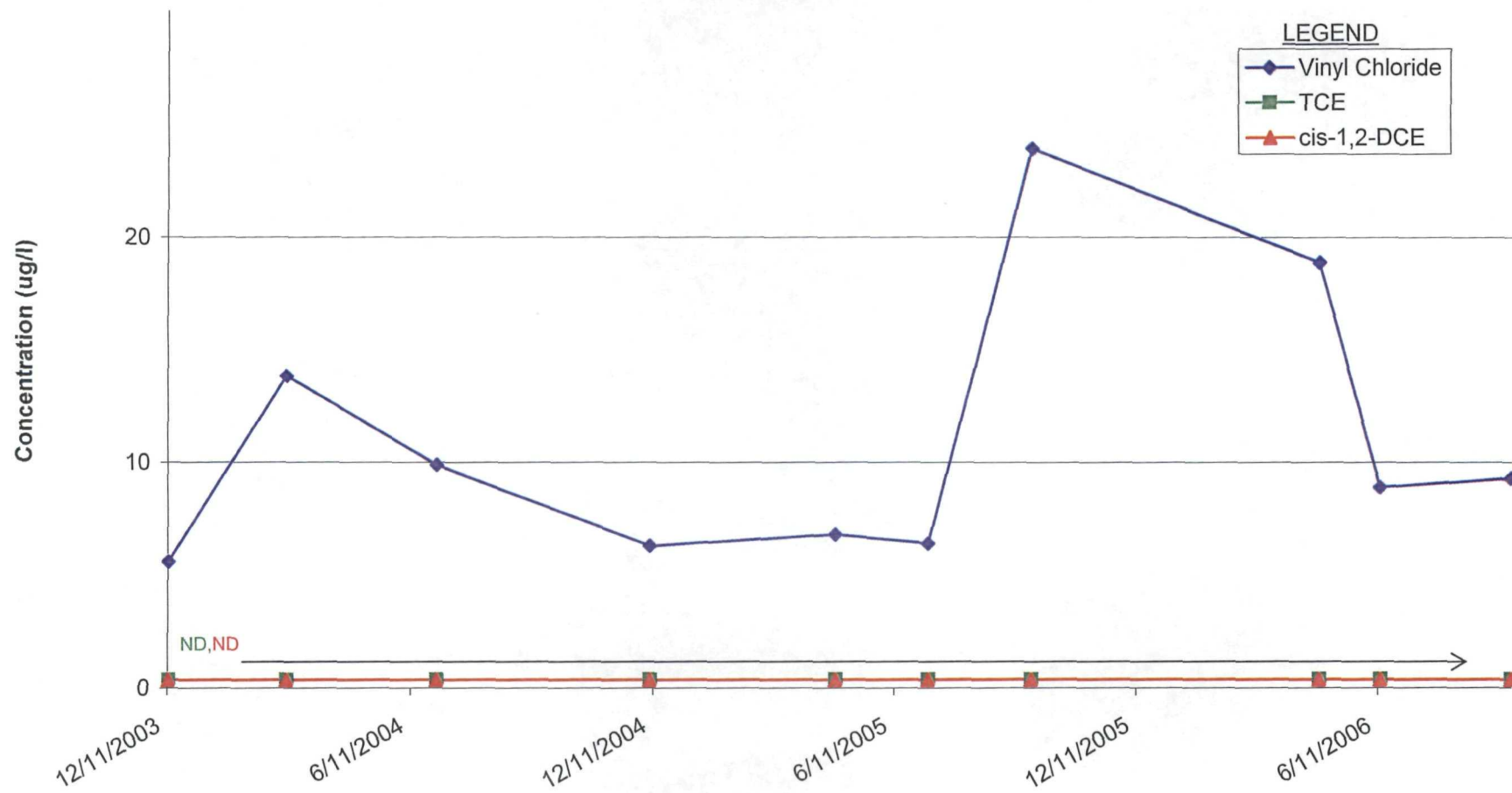


FIGURE 12  
GW-17D  
VC, TCE, and cis-1,2-DCE Concentrations Over Time  
December 2006 Quarterly Monitoring Event  
Rose Township Site  
Holly, Michigan

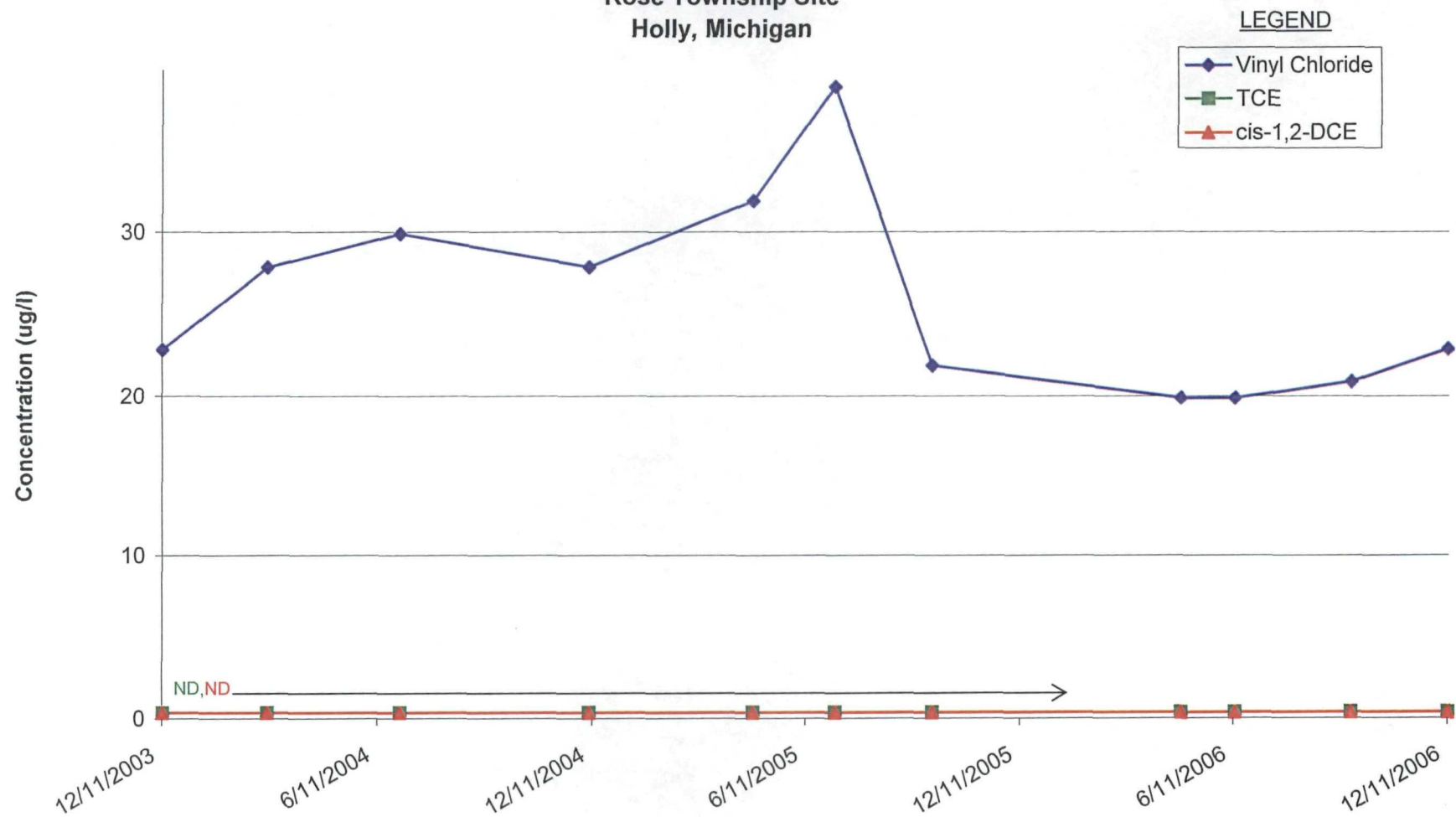


FIGURE 13

GW-18

VC, TCE, and cis-1,2-DCE Concentrations Over Time

December 2006 Quarterly Monitoring Event

Rose Township Site

Holly, Michigan

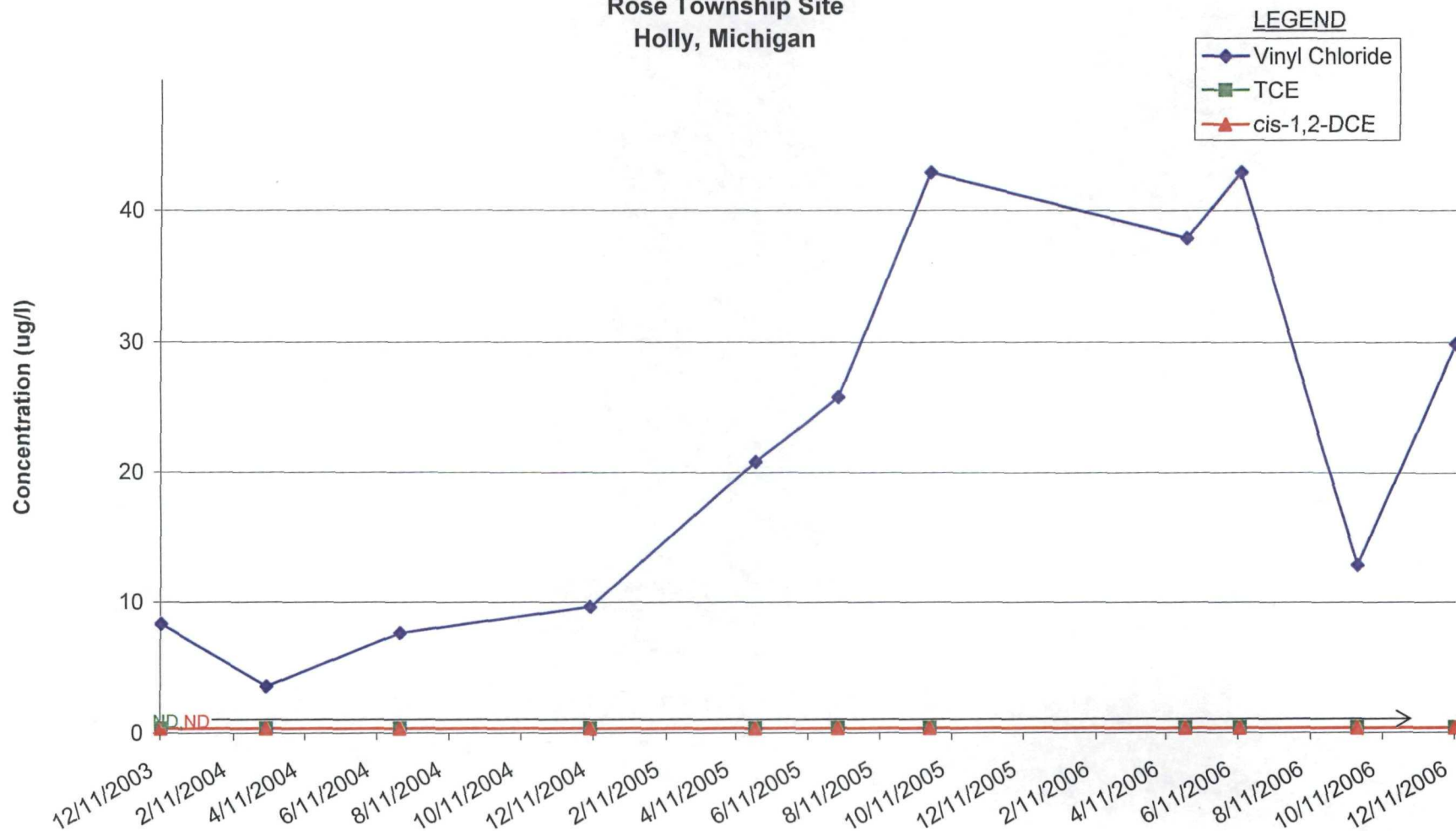


FIGURE 14  
GW-19S  
VC, TCE, and cis-1,2-DCE Concentrations Over Time  
December 2006 Quarterly Monitoring Event  
Rose Township Site  
Holly, Michigan

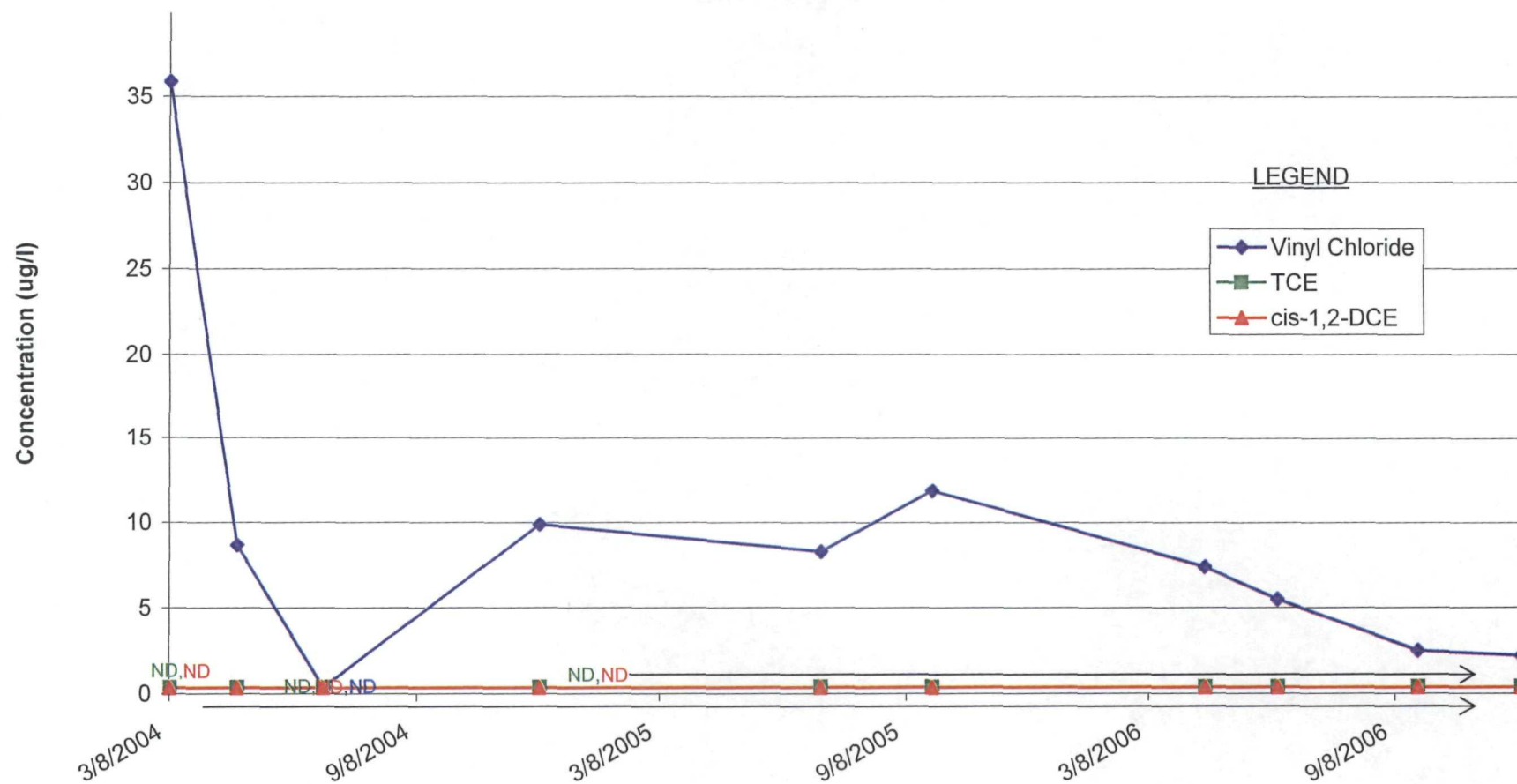
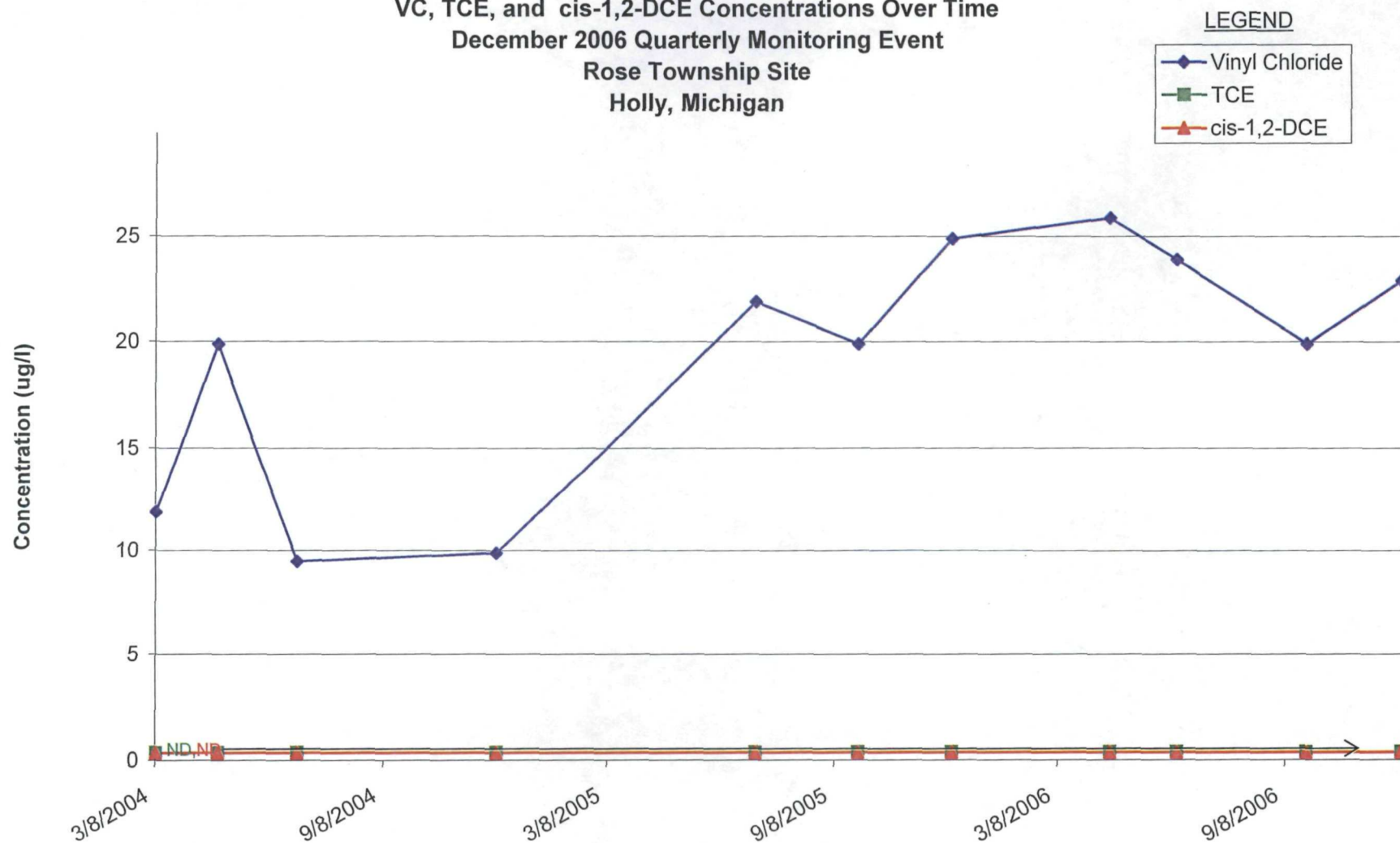
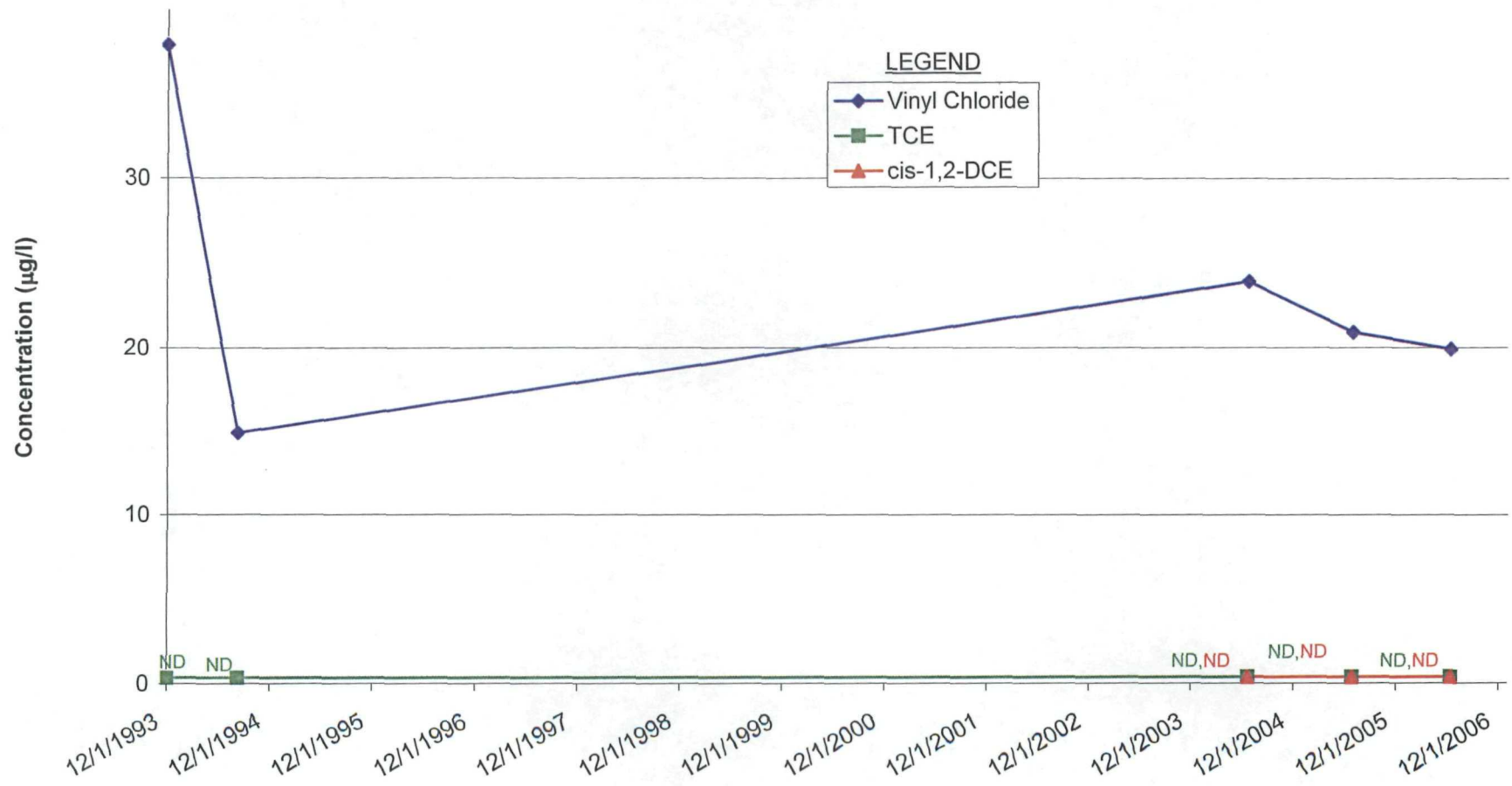


FIGURE 15  
GW-20D  
VC, TCE, and cis-1,2-DCE Concentrations Over Time  
December 2006 Quarterly Monitoring Event  
Rose Township Site  
Holly, Michigan





**FIGURE 16**  
**MW-2I**  
**VC, TCE, and cis-1,2-DCE Concentrations Over Time**  
**December 2006 Quarterly Monitoring Event**  
**Rose Township Site**  
**Holly, Michigan**



**FIGURE 17**  
**MW-3I**  
**VC, Tce, and cis-1,2-DCE Concentrations Over Time**  
**December 2006 Quarterly Monitoring Event**  
**Rose Township Site**  
**Holly, Michigan**

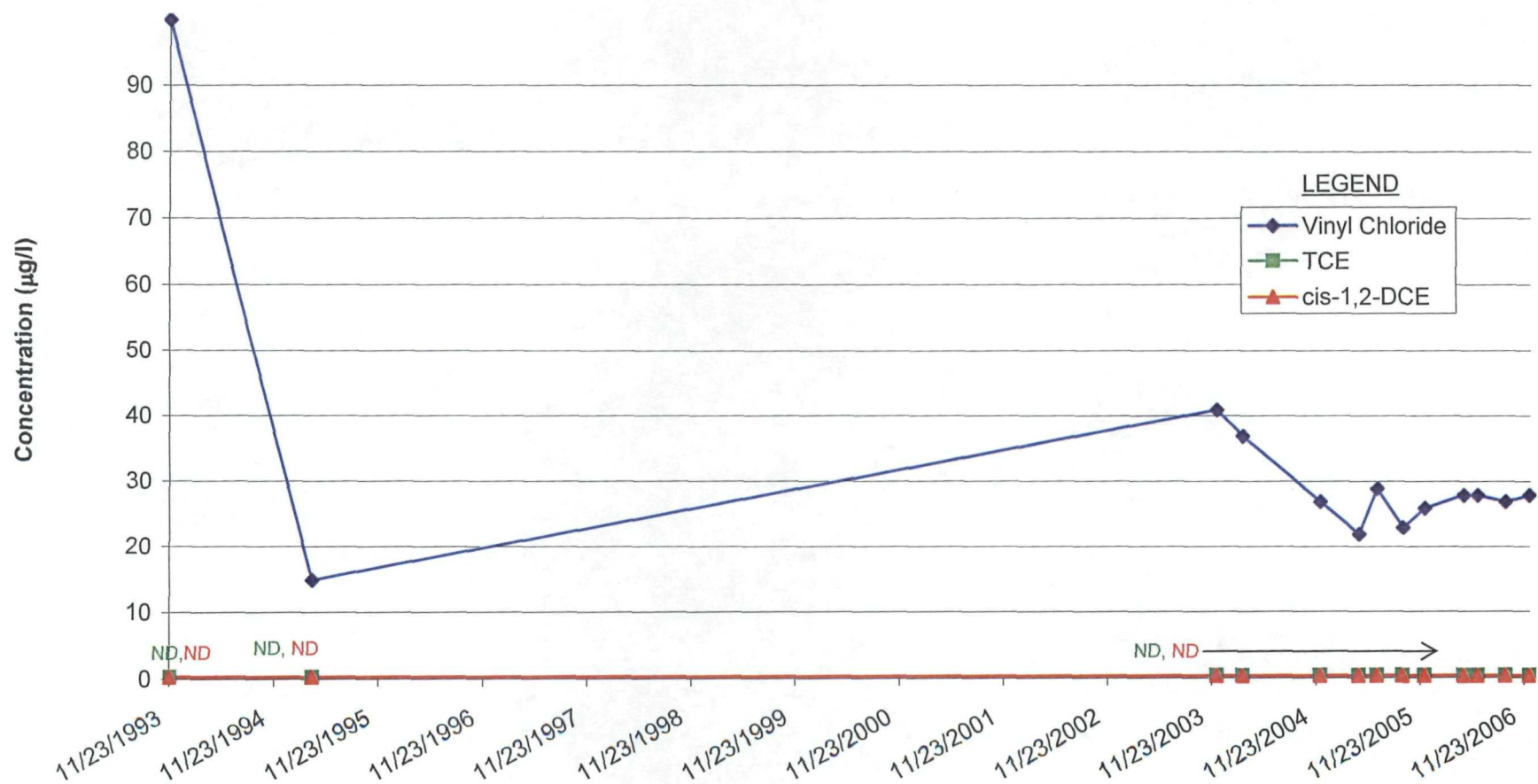
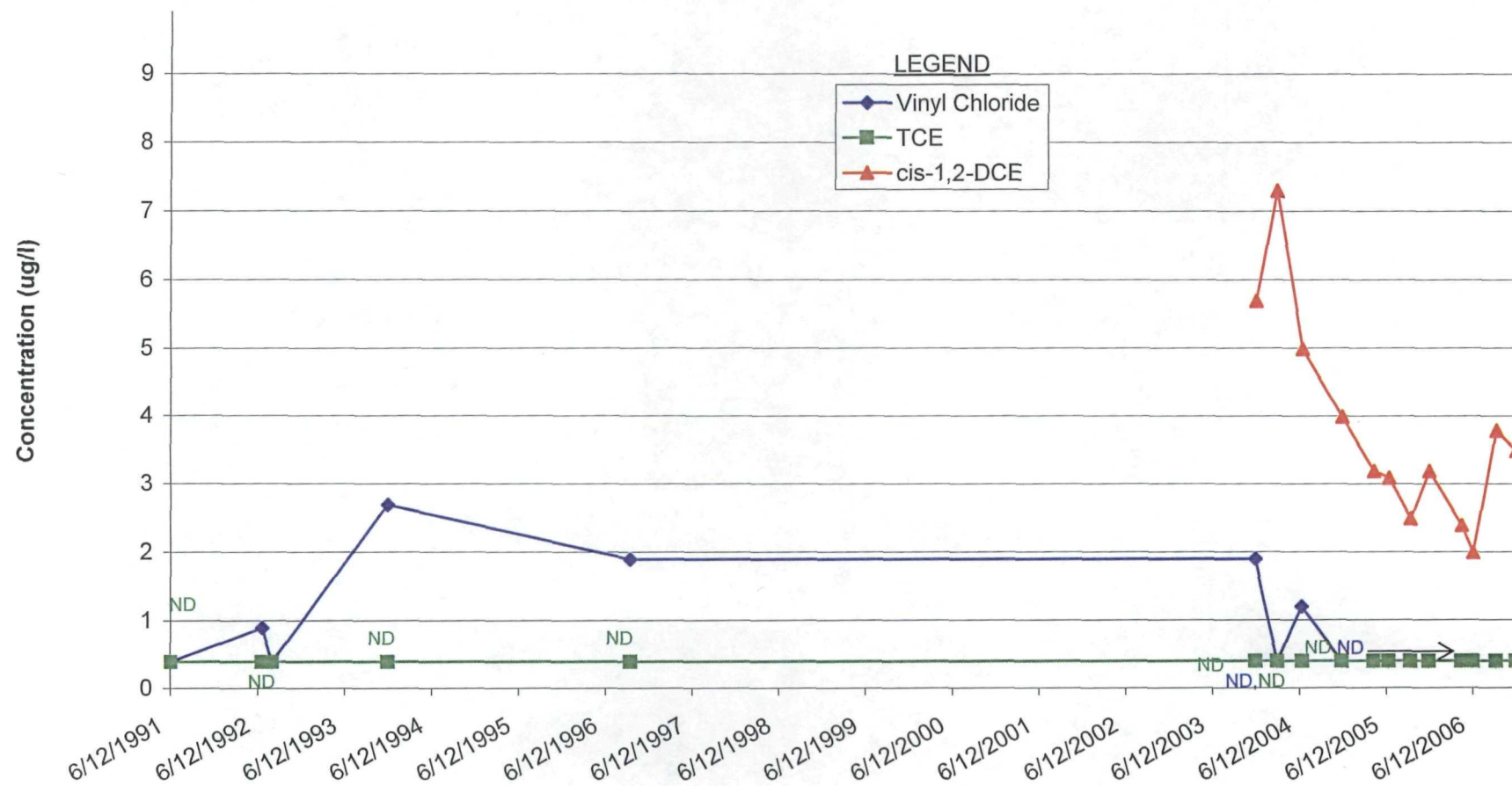
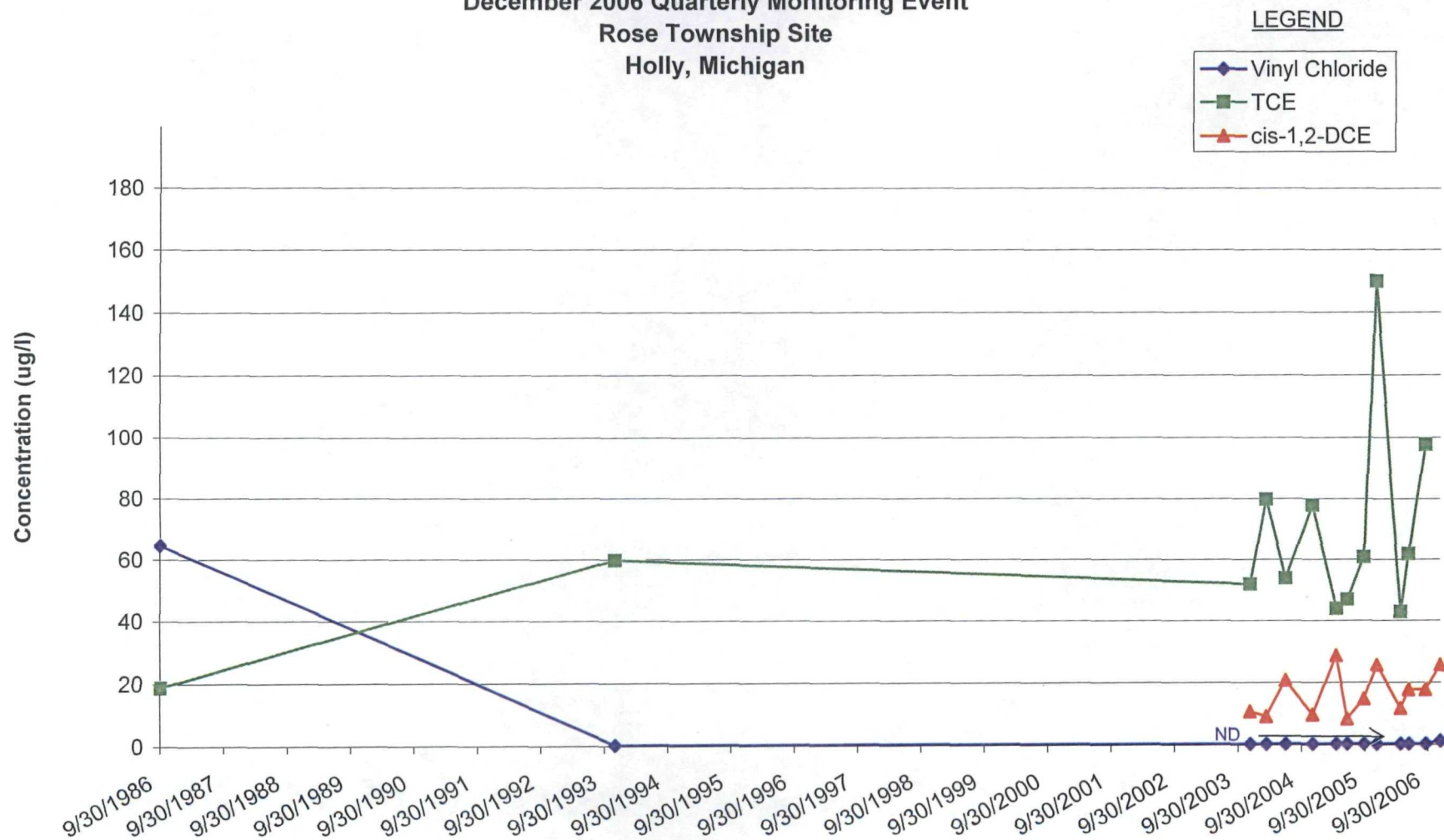




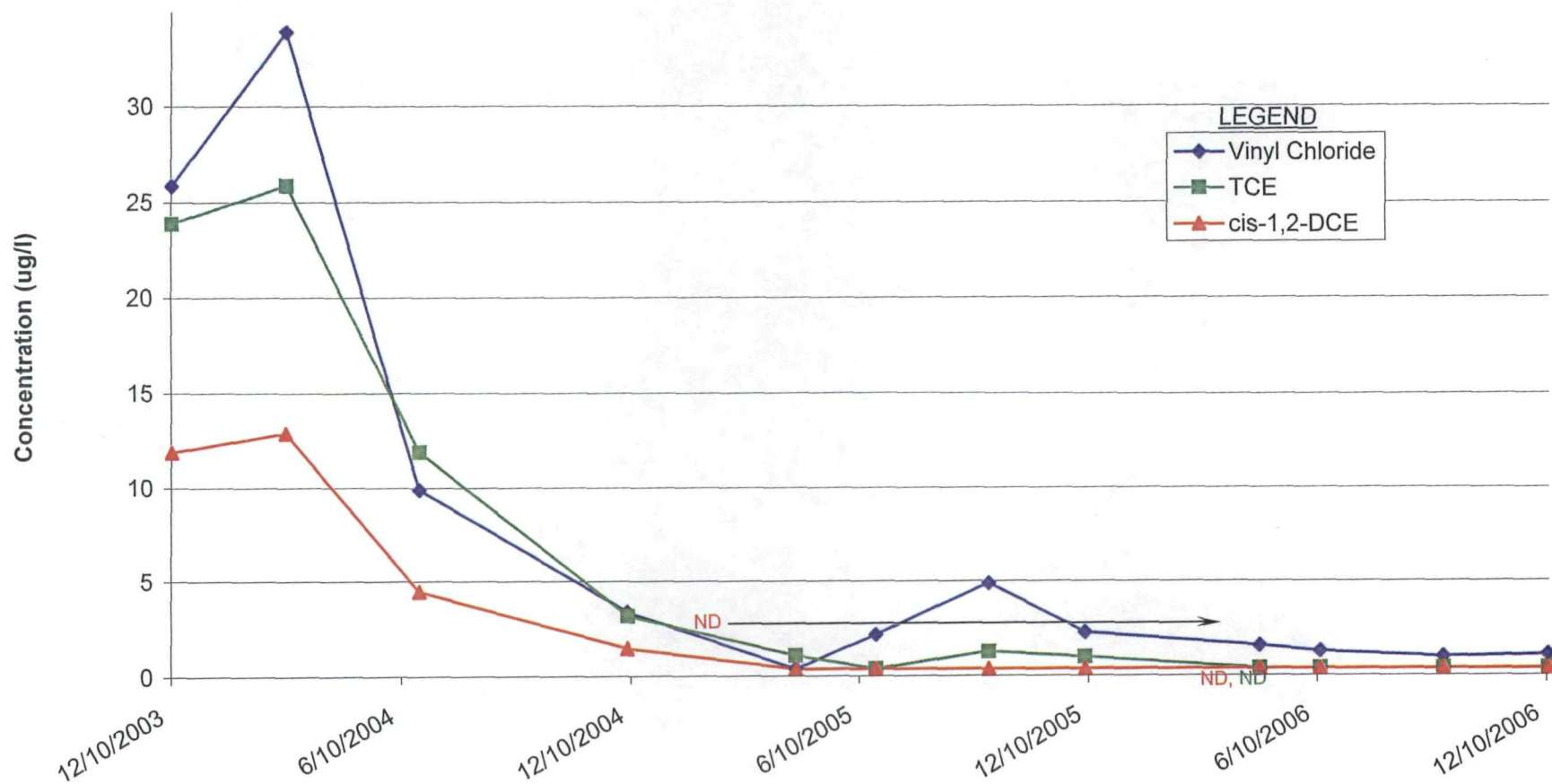
FIGURE 18  
MW-103S  
VC, TCE, and cis-1,2-DCE Concentrations Over Time  
December 2006 Quarterly Monitoring Event  
Rose Township Site  
Holly, Michigan



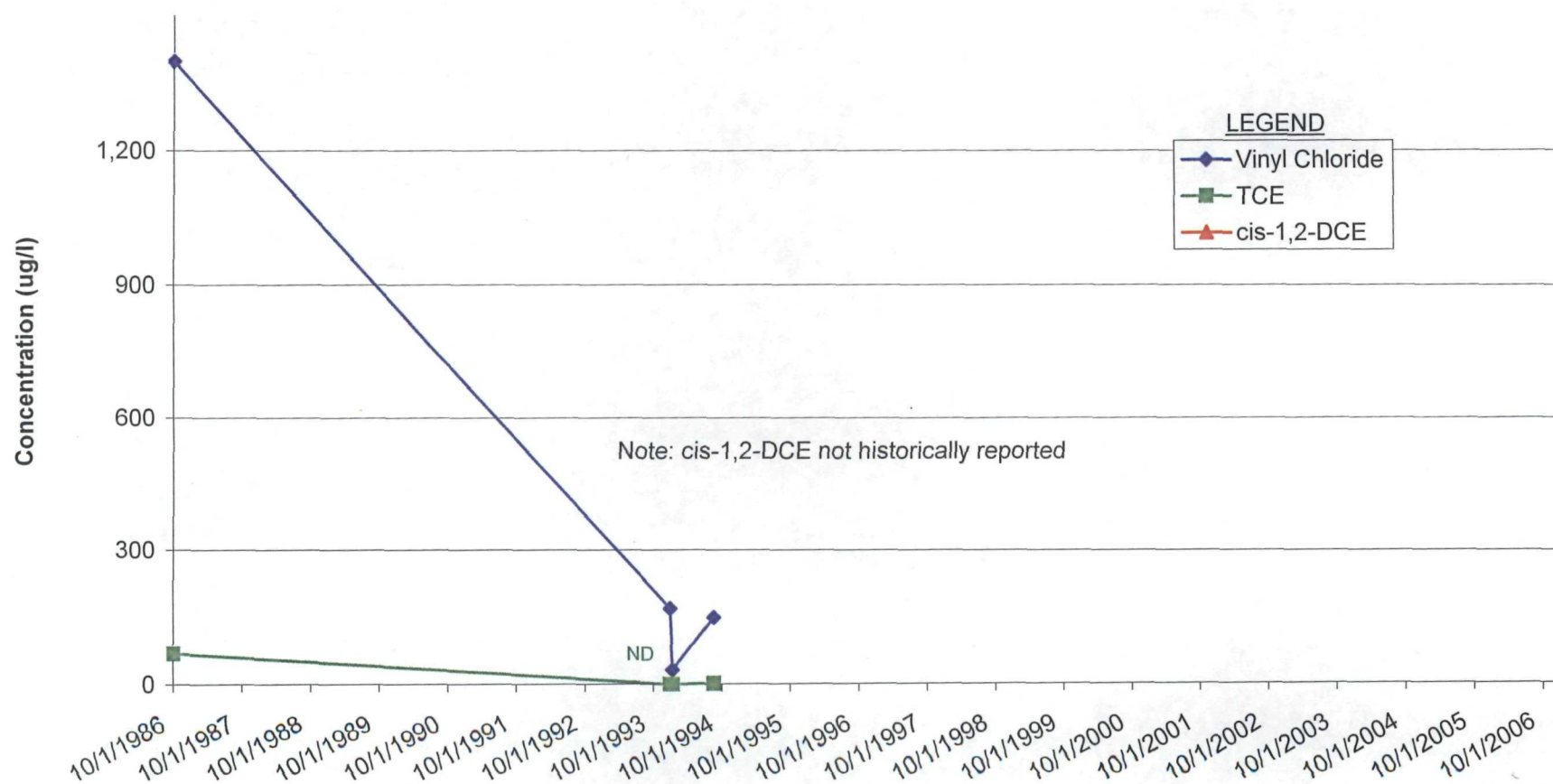
**FIGURE 19**  
**RW-1D**  
**VC, TCE, and cis-1,2-DCE Concentrations Over Time**  
**December 2006 Quarterly Monitoring Event**  
**Rose Township Site**  
**Holly, Michigan**



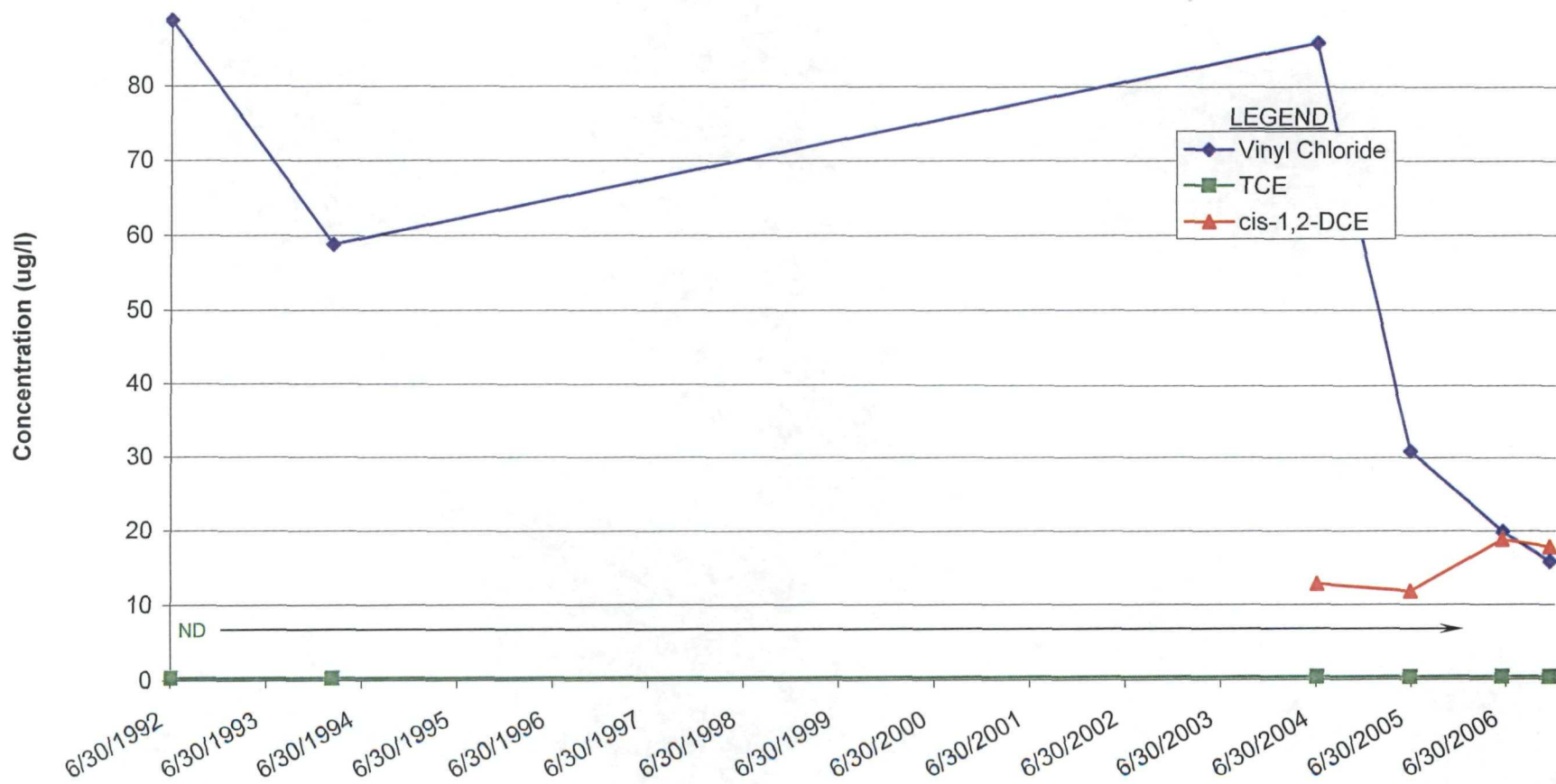
**FIGURE 20**  
**RW-5S**  
**VC, TCE, and cis-1,2-DCE Concentrations Over Time**  
**December 2006 Quarterly Monitoring Event**  
**Rose Township Site**  
**Holly, Michigan**



**FIGURE 21**  
**RW-5D**  
**VC, TCE, and cis-1,2-DCE Concentrations Over Time**  
**December 2006 Quarterly Monitoring Event**  
**Rose Township Site**  
**Holly, Michigan**



**FIGURE 22**  
**PW-1**  
**VC, TCE and cis-1,2-DCE Concentrations Over Time**  
**December 2006 Quarterly Monitoring Event**  
**Rose Township Site**  
**Holly, Michigan**





**FIGURE 23**  
**PW-3**  
**VC, TCE, and cis-1,2-DCE Concentrations Over Time**  
**December 2006 Quarterly Monitoring Event**  
**Rose Township Site**  
**Holly, Michigan**

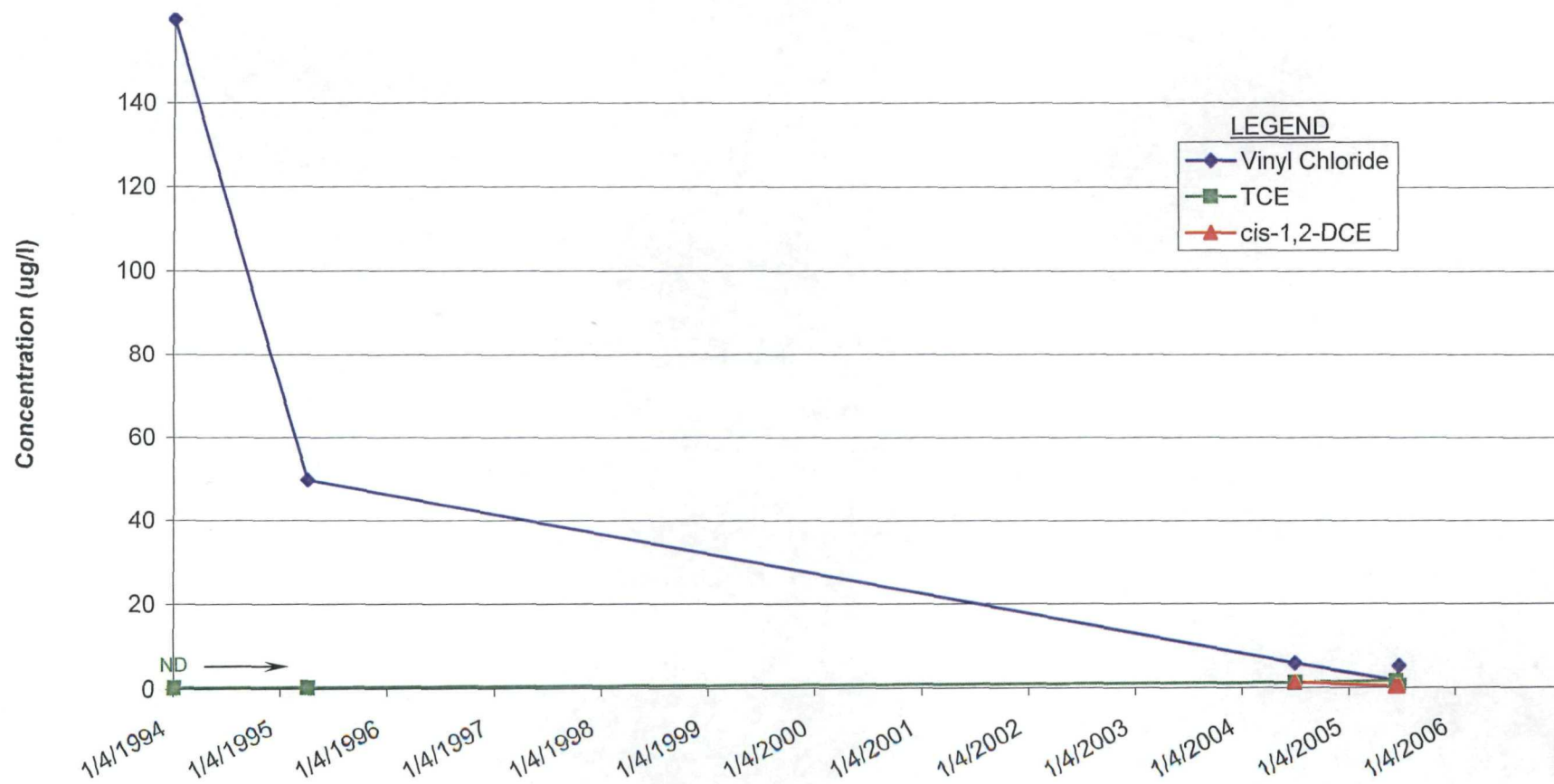
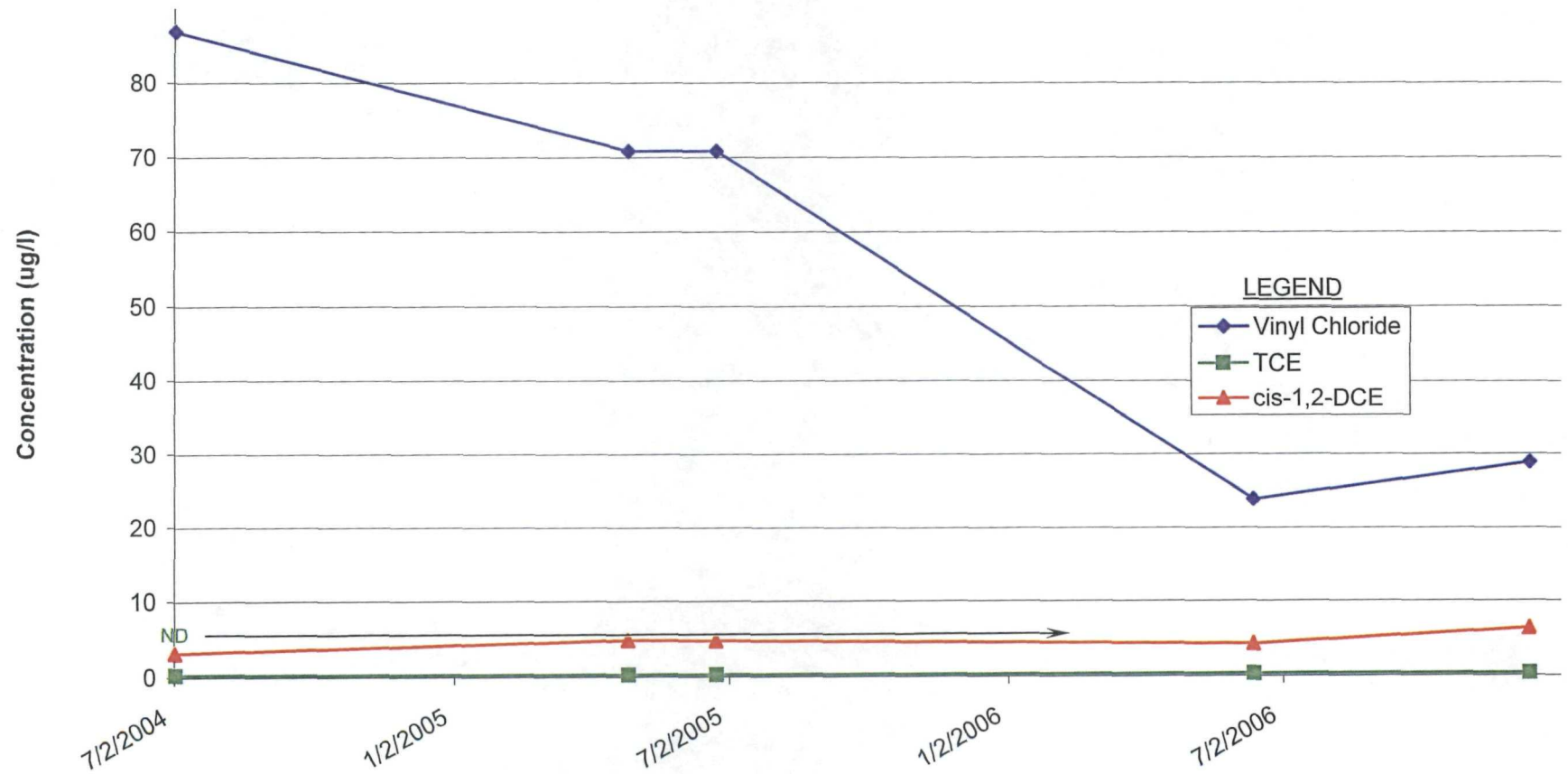
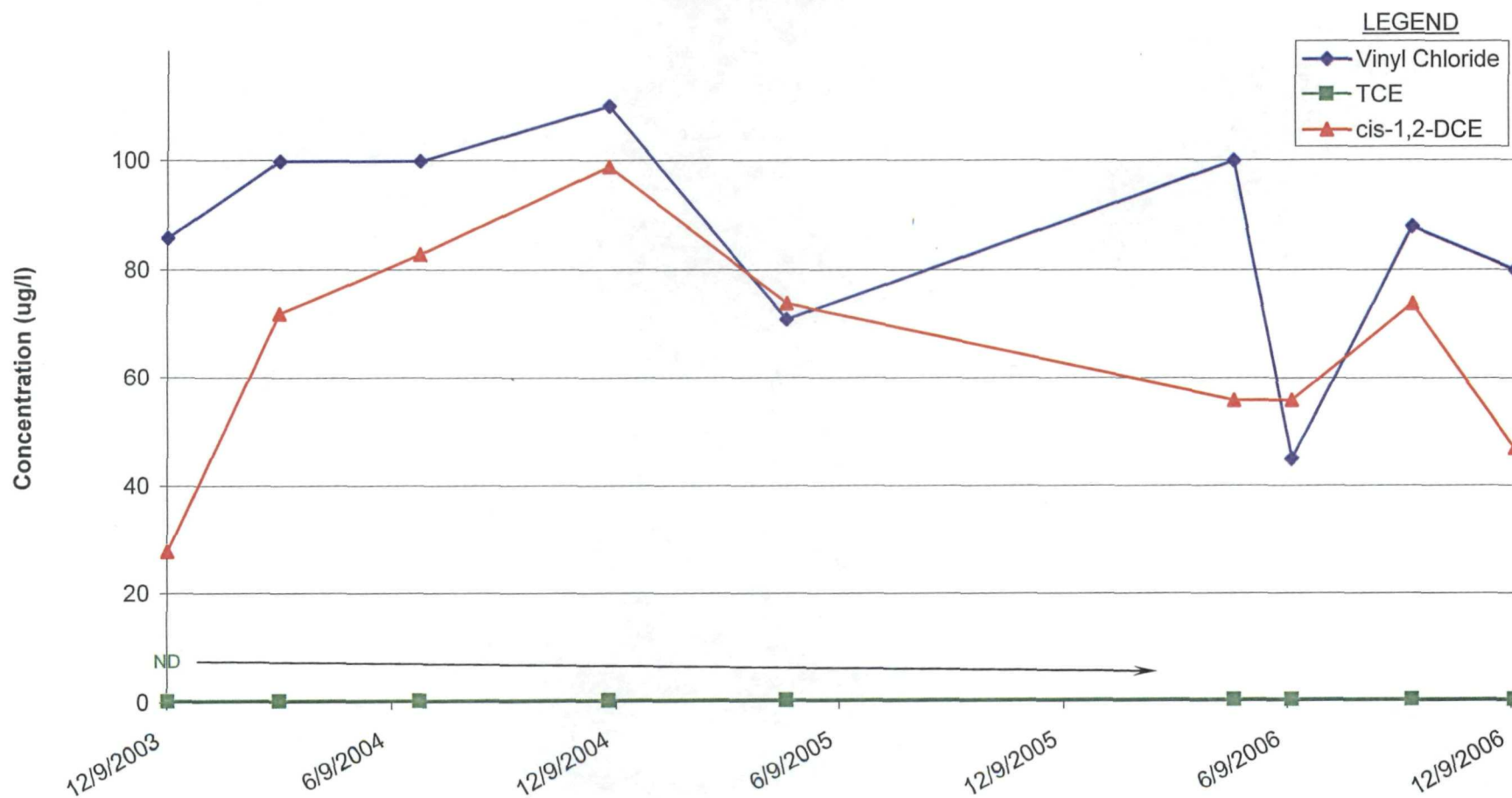


FIGURE 24  
PW-6  
VC, TCE, and cis-1,2-DCE Concentrations Over Time  
December 2006 Quarterly Monitoring Event  
Rose Township Site  
Holly, Michigan

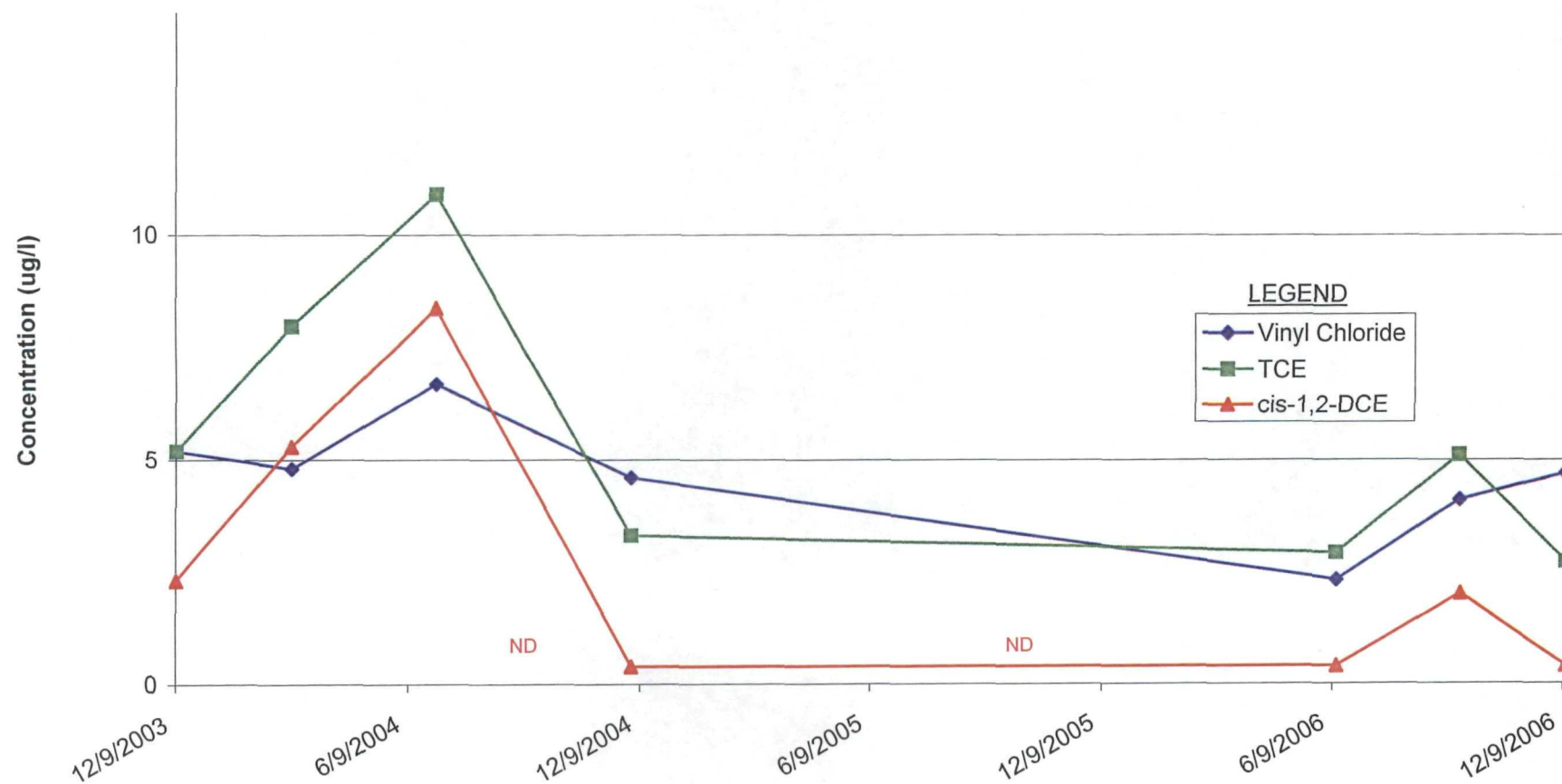


**FIGURE 25**  
**PW-7**  
**VC, TCE, and cis-1,2-DCE Concentrations Over Time**  
**December 2006 Quarterly Monitoring Event**  
**Rose Township Site**  
**Holly, Michigan**





**FIGURE 26**  
**PW-8**  
**VC, TCE, and cis-1,2-DCE Concentrations Over Time**  
**December 2006 Quarterly Monitoring Event**  
**Rose Township Site**  
**Holly, Michigan**



/

**Tables**



Well ID	Northing	Easting	Top of Casing Elevation  (ft. AMSL)	Ground Surface  (ft. BTOC)	Ground Surface Elevation (ft. AMSL)	Screened Interval			Screen Length  (feet)	Screened Interval		Total Depth  (ft. BGS)	Total Depth  (ft. AMSL)	Flowing Well	December-06	
						Screen Minimum Depth (ft. BGS)	Screen Maximum Depth (ft. BGS)	Screen Minimum Depth (ft. AMSL)		Screen Maximum Depth (ft. AMSL)	Water Level Measurement (ft ATOC)				Head Elevation (ft AMSL)	
PW-8	446008.32	13320516.99	1038.71	2.50	1036.21	39.0	115.0	76.0	997.2	921.2	115.0	921.2	No	NM		
PW-9	445484.71	13320563.03	1044.54	2.54	1042.00	40.0	100.0	60.0	1002.0	942.0	100.0	942.0	No	NM		
RW-1	445818.72	13320282.99	1019.97	2.83	1017.14	27.0	30.0	3.0	990.1	987.1	30.0	987.1	No	-19.23	1000.74	
RW-1D	445817.80	13320288.04	1019.60	2.46	1017.14	66.5	69.5	3.0	950.6	947.6	69.5	947.6	No	-18.96	1000.64	
RW-2	445567.73	13320631.06	1050.02	3.67	1046.35	45.0	48.0	3.0	1001.4	998.4	48.0	998.4	No	-48.92	1001.10	
RW-3	445227.94	13320641.44	1052.52	2.35	1050.17	54.0	57.0	3.0	996.2	993.2	57.0	993.2	No	Destroyed		
RW-4	445417.19	13320284.45	1023.66	2.79	1020.87	29.0	32.0	3.0	991.9	988.9	32.0	988.9	No	-22.52	1001.14	
RW-5S	445387.36	13320454.65	1039.73	2.75	1037.03	47.0	50.0	3.0	990.0	987.0	50.0	987.0	No	-38.69	1001.09	
RW-5D	445389.07	13320457.55	1039.37	2.50	1036.87	60.0	65.0	5.0	976.9	971.9	65.0	971.9	No	-38.10	1001.27	
RW-6	444915.45	13320450.88	1026.42	2.83	1023.59	31.0	34.0	3.0	992.6	989.6	34.0	989.6	No	-24.73	1001.69	
RW-6D	444915.45	13320450.88	1026.98	3.50	1023.48	66.0	69.0	3.0	957.5	954.5	69.0	954.5	No	-25.36	1001.62	
RW-7	445120.68	13320242.82	1022.74	2.63	1020.11	13.5	18.5	5.0	1006.6	1001.6	18.5	1001.6	No	Dry		
RW-8	445233.79	13320192.70	1023.06	2.75	1020.31	37.0	40.0	3.0	983.3	980.3	40.0	980.3	No	-21.79	1001.27	
RW-8D	445237.45	13320191.79	1022.20	1.75	1020.45	70.0	73.0	3.0	950.5	947.5	73.0	947.5	No	-20.92	1001.28	
RW-9	445309.05	13319941.89	999.99	2.92	997.07	11.0	14.0	3.0	986.1	983.1	14.0	983.1	No	-7.58	992.41	
RW-10	445809.13	13320706.46	1023.13	3.21	1019.92	15.0	18.0	3.0	1004.9	1001.9	18.0	1001.9	No	-9.04	1014.09	
RW-11	446529.54	13320346.67	1035.04	3.04	1032.00	33.0	36.0	3.0	999.0	996.0	36.0	996.0	No	-25.95	1009.09	
RW-12	444963.45	13320929.00	1046.84	2.83	1044.01	44.0	47.0	3.0	1000.0	997.0	47.0	997.0	No	-45.12	1001.72	
RW-13	444435.24	13320447.67	1010.77	3.00	1007.77	11.0	14.0	3.0	996.8	993.8	14.0	993.8	No	-14.65	996.12	
RW-14	446202.95	13320387.44	1031.74	3.25	1028.49	30.0	33.0	3.0	998.5	995.5	33.0	995.5	No	-32.76	998.98	
RW-15	445450.12	13320805.75	1051.04	3.29	1047.75	51.0	53.0	2.0	996.8	994.8	53.0	994.8	No	-49.88	1001.16	
RW-16	444272.30	13319677.20	1011.43	3.50	1007.93	17.5	20.5	3.0	990.4	987.4	20.5	987.4	No	-9.03	1002.40	
RW-17	445605.90	13321164.30														

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**Table 2**  
**Summary of VOC Analytical Results in Groundwater Samples**  
**Rose Township Demode Road Site**  
**Holly, Michigan**  
**Samples Collected December 11 through 14, 2006**  
**Earth Tech Project No. 89861.02.04**

Volatile Organic Compounds (µg/L)	ROD Target Cleanup Levels <sup>A</sup>		2004 Federal Drinking Water Maximum Contaminant Levels in µg/L	MDEQ Part 201 Generic Cleanup Criteria Concentration in µg/L			Sample Location Concentration in µg/L											
	Phase I Target Concentration Limits in µg/L	Phase II Target Concentration Limits in µg/L		Residential Drinking Water Criteria	Groundwater Surface Water Interface Criteria	Groundwater Contact Criteria	DNR-1	DNR-1 (dup)	DNR-4D	DNR-6	DNR-7	GW-4D	GW-5I	GW-6D	GW-17D	GW-17I	GW-18	GW-19D
Benzene	1.5	0.133	5	5	200	11,000	ND (1.0)	ND (1.0)	ND (1.0)	NS	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)
Carbon Disulfide				800	ID	1,200,000	ND (5.0)	ND (5.0)	ND (5.0)	NS	ND (5.0)	ND (5.0)	ND (5.0)	ND (5.0)	ND (5.0)	ND (5.0)	ND (5.0)	ND (5.0)
Chlorobenzene	60	60	100	100	47	86,000	ND (1.0)	ND (1.0)	ND (1.0)	NS	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)
Chloroethane	—	—	—	430	ID	440,000	ND (1.0)	ND (1.0)	ND (1.0)	NS	21	ND (1.0)	4.8	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)
1,1-Dichloroethane	—	—	—	880	740	2,400,000	ND (1.0)	ND (1.0)	ND (1.0)	NS	5.7	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)
cis-1,2-Dichloroethene	—	—	70	70	620	200,000	ND (1.0)	ND (1.0)	ND (1.0)	NS	170	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)
trans-1,2-Dichloroethene	—	—	100	100	1500	220,000	ND (1.0)	ND (1.0)	ND (1.0)	NS	24	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)
Ethylbenzene	680	680	700	74	18	170,000	ND (1.0)	ND (1.0)	ND (1.0)	NS	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)
Trichloroethene	1.5	0.627	5	5	200	22,000	ND (1.0)	ND (1.0)	ND (1.0)	NS	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)
1,1,1-Trichloroethane	—	—	200	200	200	1,300,000	ND (1.0)	ND (1.0)	ND (1.0)	NS	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)
Vinyl Chloride	1	0.003	2	2	15	1,000	ND (1.0)	ND (1.0)	ND (1.0)	NS	89	ND (1.0)	140	ND (1.0)	23	9.0	30	ND (1.0)

**Notes:**

- ROD -Record of Decision, EPA September 30, 1987.  
A -Phase I and Phase II TCLs as identified in the Remedial Design and Remedial Action Work Plan (Fred C. Hart Associates, Inc., et al, September 18, 1989).  
MDEQ -Michigan Department of Environmental Quality.  
ID -Inadequate data for MDEQ to develop criterion.  
ND (1.0) -Not detected above the analytical method reporting limits. The analytical method reporting limits are included in parenthesis.  
µg/L -Micrograms per liter.  
— -No standard available.  
160 -Indicates an exceedance of one or more criteria ( ROD Target Cleanup Levels, MCLs, MDEQ Part 201).

**Table 2**  
**Summary of VOC Analytical Results in Groundwater Samples**  
**Rose Township Demode Road Site**  
**Holly, Michigan**  
**Samples Collected December 11 through 14, 2006**  
**Earth Tech Project No. 89861.02.04**

Volatile Organic Compounds (µg/L)	ROD Target Cleanup Levels <sup>A</sup>		2004 Federal Drinking Water Maximum Contaminant Levels in µg/L	MDEQ Part 201 Generic Cleanup Criteria Concentration in µg/L			Sample Location Concentration in µg/L											
	Phase I Target Concentration Limits in µg/L	Phase II Target Concentration Limits in µg/L		Residential Drinking Water Criteria	Groundwater Surface Water Interface Criteria	Groundwater Contact Criteria	GW-19S	GW-19S (dup)	GW-20D	GW-20I	GW-21D	GW-21S	GW-22D	GW-22I	GW-22S	GW-22S (dup)	GW-23D	GW-23I
Benzene	1.5	0.133	5	5	200	11,000	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)
Carbon Disulfide				800	ID	1,200,000	ND (5.0)	ND (5.0)	ND (5.0)	ND (5.0)	ND (5.0)	ND (5.0)	ND (5.0)	ND (5.0)	ND (5.0)	ND (5.0)	ND (5.0)	ND (5.0)
Chlorobenzene	60	60	100	100	47	86,000	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)
Chloroethane	—	—	—	430	ID	440,000	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)
1,1-Dichloroethane	—	—	—	880	740	2,400,000	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)
cis-1,2-Dichloroethene	—	—	70	70	620	200,000	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)
trans-1,2-Dichloroethene	—	—	100	100	1500	220,000	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)
Ethylbenzene	680	680	700	74	18	170,000	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)
Trichloroethene	1.5	0.627	5	5	200	22,000	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)
1,1,1-Trichloroethane	—	—	200	200	200	1,300,000	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)
Vinyl Chloride	1	0.003	2	2	15	1,000	2.3	2.2	2.3	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)

**Notes:**  
 ROD -Record of Decision, EPA September 30, 1987.  
 A -Phase I and Phase II TCLs as identified in the Remedial Design and Remedial Action Work Plan (Fred C. Hart Associates, Inc., et al, Septen  
 MDEQ -Michigan Department of Environmental Quality.  
 ID -Inadequate data for MDEQ to develop criterion.  
 ND (1.0) -Not detected above the analytical method reporting limits. The analytical method reporting limits are included in parenthesis.  
 µg/L -Micrograms per liter.  
 — -No standard available.  
 160 -Indicates an exceedance of one or more criteria ( ROD Target Cleanup Levels, MCLs, MDEQ Part 201).

Table 2  
Summary of VOC Analytical Results in Groundwater Samples  
Rose Township Demode Road Site  
Holly, Michigan  
Samples Collected December 11 through 14, 2006  
Earth Tech Project No. 89861.02.04

Volatile Organic Compounds (µg/L)	ROD Target Cleanup Levels <sup>A</sup>		2004 Federal Drinking Water Maximum Contaminant Levels in µg/L	MDEQ Part 201 Generic Cleanup Criteria Concentration in µg/L			Sample Location Concentration in µg/L																	
	Phase I Target Concentration Limits in µg/L	Phase II Target Concentration Limits in µg/L		Residential Drinking Water Criteria	Groundwater Surface Water Interface Criteria	Groundwater Contact Criteria	GW-23S	GW-24D	GW-24I	GW-25D	GW-25I	GW-26D	GW-26I	GW-26I (dup)	MW-102D	MW103S	MW-3I	PW-1	PW-4	PW-6	PW-7	PW-8	RW-1D	RW-5S
Benzene	1.5	0.133	5	5	200	11,000	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	7.6	ND (1.0)	ND (1.0)	ND (1.0)
Carbon Disulfide				800	ID	1,200,000	ND (5.0)	ND (5.0)	ND (5.0)	ND (5.0)	ND (5.0)	7.9	ND (5.0)	ND (5.0)	ND (5.0)	ND (5.0)	ND (5.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (5.0)	ND (5.0)	ND (5.0)	ND (5.0)
Chlorobenzene	60	60	100	100	47	86,000	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	8.6
Chloroethane	—	—	—	430	ID	440,000	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	2.6	2.0	ND (1.0)	ND (1.0)
1,1-Dichloroethane	—	—	—	880	740	2,400,000	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	5.7	ND (1.0)	ND (1.0)	ND (1.0)
cis-1,2-Dichloroethene	—	—	70	70	620	200,000	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	3.6	ND (1.0)	18	ND (1.0)	6.5	47	ND (1.0)	26	ND (1.0)
trans-1,2-Dichloroethene	—	—	100	100	1500	220,000	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	1.3	ND (1.0)	1.3	ND (1.0)	ND (1.0)	22	ND (1.0)	70	ND (1.0)
Ethylbenzene	680	680	700	74	18	170,000	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	1.8
Trichloroethene	1.5	0.627	5	5	200	22,000	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	2.7	98	ND (1.0)
1,1,1-Trichloroethane	—	—	200	200	200	1,300,000	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	15	ND (1.0)	ND (1.0)	ND (1.0)
Vinyl Chloride	1	0.003	2	2	15	1,000	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	2.1	2.1	2.1	2.1	1.5	1.2	

**Notes:**  
ROD -Record of Decision, EPA September 30, 1987.  
A -Phase I and Phase II TCLs identified in the Remedial Design and Remedial Action Work Plan (Fred C. Hart Associates, Inc., et al, Septen  
MDEQ -Michigan Department of Environmental Quality.  
ID -Inadequate data for MDEQ to develop criterion.  
ND (1.0) -Not detected above the analytical method reporting limits. The analytical method reporting limits are included in parenthesis.  
µg/L -Micrograms per liter.  
— -No standard available.  
160 -Indicates an exceedance of one or more criteria ( ROD Target Cleanup Levels, MCLs, MDEQ Part 201).

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**Notes:**  
All units are in micrograms per liter (ug/L).  
"–" indicates that the compound was not analyzed  
"ND" indicates not detected above the laboratory reporting limit (detection limit not available).  
"<" indicates less than the laboratory reporting limit shown  
"dup)" indicates that the sample is a duplicate collected for quality assurance purposes  
"dup)" indicates that a duplicate sample was collected using a bladder pump (for comparison) instead of a peristaltic pump (original sample collected with peristaltic pump)  
Analyses were analyzed via USEPA Method 8260 for volatile organic compounds

TCE - Trichloroethene  
Cis-1,2-DCE + Cis-1,2-Dichloroethene

**Table 4**  
**Summary of Biogeochemical and Field Parameters in Groundwater Samples**  
**Rose Township Demoda Road Site**  
**Holly, Michigan**  
**Samples Collected December 11 through 14, 2006**  
**Earth Tech Project No. 89861.02.04**

Biogeochemical and Field Parameters	Units	Sample Locations														
		DNR-1	DNR-1 (dup)	DNR-4D	DNR-6	DNR-7	GW-4D	GW-5I	GW-6D	GW-17I	GW-17D	GW-18	GW-19S	GW-19S (dup)	GW-19D	GW-20I
Field Parameters																
pH	S.U.	7.77	NA	7.93	8.60	7.53	7.66	7.81	7.45	7.51	7.77	7.47	7.69	NA	7.65	7.64
Conductivity	µS/cm	528	NA	559	268	631	583	591	585	585	578	589	583	NA	600	610
Dissolved Oxygen	mg/L	0.22	NA	0.35	0.56	0.28	0.14	0.19	0.07	0.16	0.30	0.32	0.22	NA	0.17	0.13
Temperature	C°	8.79	NA	9.51	9.60	9.39	9.62	9.56	9.45	9.19	9.49	8.66	9.00	NA	9.08	8.90
Oxidation/Reduction Potential	mv	-111	NA	-111	-102	-129	-151	-140	-85	-87	-152	-77	-132	NA	-138	-140
Salinity	PSS	0.25	NA	0.27	0.13	0.30	0.28	0.28	0.28	0.28	0.28	0.28	0.28	NA	0.29	0.29
Turbidity	NTU	2.1	NA	10.4	251.0	31.1	>9.99	41.8	0.4	3.0	0.7	1.2	0.6	NA	0.01	0.8
Sulfide	mg/L	0.58	NA	0.68	NM	0.45	0.07	0.20	0.00	0.01	0.02	0.00	0.02	NA	0.43	0.03
Dissolved Iron	mg/L	2.47	NA	NM	NM	1.99	2.10	1.63	2.15	1.85	2.42	1.79	1.62	NA	1.60	1.50
Dissolved Manganese	mg/L	0.1	NA	NM	NM	0.7	NM	NM	NM	NM	NM	NM	NM	NA	NS	NM
Biogeochemical Parameters																
Nitrogen, Ammonia	mg/L	0.22	0.23	0.10	NS	0.050	0.12	0.077	<0.050	0.089	0.078	0.10	<0.050	<0.050	0.093	0.11
Total Organic Carbon	mg/L	1.9	1.9	1.8	NS	1.9	1.7	1.7	1.5	1.7	1.6	1.6	1.7	1.6	1.6	1.5
Nitrogen, Nitrate	mg/L	<0.050	<0.050	<0.050	NS	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Nitrogen, Nitrite	mg/L	<0.050	<0.050	<0.050	NS	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Sulfate	mg/L	<5.0	<5.0	13	NS	13	22	17	25	14	11	12	27	27	29	16
Chloride	mg/L	<1.0	<1.0	4.6	NS	6.1	1.9	3.8	2.7	3.7	2.3	2.2	4.0	4.0	5.2	6.4
Total Alkalinity	mg/L	290	300	290	NS	320	300	310	300	310	310	330	290	290	300	320
Dissolved Gases																
Ethane Gas in Water	µg/L	<5.0	<5.0	<1.0	NS	<2.0	<1.0	<4.0	<1.0	<4.0	<4.0	<2.0	<1.0	<1.0	<1.0	<1.0
Ethane Gas in Water	µg/L	<5.0	<5.0	<1.0	NS	3.6	<1.0	<4.0	<1.0	<4.0	<4.0	<2.0	<1.0	<1.0	<1.0	<1.0
Methane Gas in Water	µg/L	160	180	4.2	NS	73	2.8	80	2.9	87	90	57	7.2	7.1	1.8	5.9

**Notes:**

ND (5.0) -Not detected above analytical method reporting limits are listed in parenthesis.

S.U. -Standard Units  
 NTU -Nephelometric Turbidity Units  
 µS/cm -MicroSiemens per Centimeter  
 mg/L -Milligram per Liter  
 µg/L -Microgram per Liter  
 C° -Degrees Celsius  
 mv -Millivolt  
 PSS -Practical Salinity Scale  
 NA -Not available  
 NS -Sample location not sampled



Table 4  
Summary of Biogeochemical and Field Parameters in Groundwater Samples  
Rose Township Demode Road Site  
Holly, Michigan  
Samples Collected December 11 through 14, 2006  
Earth Tech Project No. 89861.02.04

Biogeochemical and Field Parameters	Units	Sample Locations														
		GW-20D	GW-21S	GW-21D	GW-22S	GW-22S (dup)	GW-22I	GW-22D	GW-23S	GW-23I	GW-23D	GW-24I	GW-24D	GW-25I	GW-25D	GW-26I
Field Parameters																
pH	S.U.	7.75	7.75	7.61	7.96	NA	7.48	8.36	7.67	8.02	7.67	7.50	7.66	7.48	7.75	7.84
Conductivity	µS/cm	574	616	529	488	NA	583	565	589	533	573	558	598	563	609	577
Dissolved Oxygen	mg/L	0.13	0.13	0.17	0.26	NA	0.17	0.20	0.39	0.57	0.27	0.34	0.25	0.12	0.21	0.24
Temperature	C°	9.01	9.21	9.23	9.02	NA	8.93	9.48	9.38	9.89	9.40	9.11	8.57	8.87	9.07	8.96
Oxidation/Reduction Potential	mv	-150	-134	-120	-147	NA	-117	-184	-131	-119	-227	-128	-162	-166	-174	-157
Salinity	PSS	0.27	0.29	0.25	0.23	NA	0.28	0.27	0.28	0.25	0.27	0.27	0.29	0.27	0.29	0.28
Turbidity	NTU	6.8	11.7	8.2	0.6	NA	0.4	1.0	0.7	0.6	2.4	0.5	0.6	1.6	1.2	1.6
Sulfide	mg/L	0.02	0.18	0.02	0.36	NA	0.20	0.80	0.02	0.69	0.80	NM	0.21	0.17	0.24	0.61
Dissolved Iron	mg/L	1.84	1.68	1.24	1.16	NA	2.14	0.00	1.90	0.09	0.00	NM	0.70	1.23	1.11	0.09
Dissolved Manganese	mg/L	NM	NM	NM	0.0	NA	0.0	0.0	0.0	0.0	0.5	NM	0.0	NM	NM	NS
Biogeochemical Parameters																
Nitrogen, Ammonia	mg/L	0.096	0.13	0.20	0.10	0.09	0.10	<0.050	0.095	<0.050	0.11	0.091	0.082	0.12	<0.050	<0.050
Total Organic Carbon	mg/L	1.4	1.5	1.4	1.7	1.6	1.8	1.5	1.6	1.9	1.7	2.0	1.4	1.9	1.6	2.0
Nitrogen, Nitrate	mg/L	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Nitrogen, Nitrite	mg/L	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Sulfate	mg/L	13	17	<5.0	19	20	18	12	24	17	<5.0	8.4	18	7.9	20	8.3
Chloride	mg/L	2.4	5.6	1.3	1.5	1.7	1.9	13	2.5	11	2.5	1.9	5.6	1.3	3.3	2.2
Total Alkalinity	mg/L	300	380	350	280	270	310	310	300	280	320	300	300	300	310	320
Dissolved Gases																
Ethane Gas in Water	µg/L	<4.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Ethene Gas in Water	µg/L	<4.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.9	<1.0	1.1	1.6	2.4	1.6	<1.0	<1.0	<1.0
Methane Gas in Water	µg/L	93	5.6	25	26	25	2.2	3	3	6.2	30	33	2.2	3.1	3.3	2.7

**Notes:**

ND (5.0) -Not detected above analytical method  
reporting limits are listed in parenthesis.

S.U. -Standard Units  
NTU -Nephelometric Turbidity Units  
µS/cm -MicroSiemens per Centimeter  
mg/L -Milligram per Liter  
µg/L -Microgram per Liter  
C° -Degrees Celsius  
mv -Millivolt  
PSS -Practical Salinity Scale  
NA -Not available  
NS -Sample location not sampled

Table 4  
Summary of Biogeochemical and Field Parameters in Groundwater Samples  
Rose Township Demode Road Site  
Holly, Michigan  
Samples Collected December 11 through 14, 2006  
Earth Tech Project No. 89861.02.04

Biogeochemical and Field Parameters	Units	Sample Locations											
		GW-26I (dup)	GW-26D	MW-3I	MW-102D	MW-103S	PW-1	PW-4	PW-6	PW-7	PW-8	RW-1D	RW-5S
Field Parameters													
pH	S.U.	NA	9.71	7.59	8.09	7.79	6.09	6.23	6.15	6.46	5.89	7.85	7.36
Conductivity	µS/cm	NA	276	617	408	597	410	412	419	408	514	516	650
Dissolved Oxygen	mg/L	NA	0.19	0.32	0.26	0.77	6.27	8.32	2.67	7.36	2.58	0.18	1.41
Temperature	C°	NA	9.17	9.13	10.02	10.40	10.31	10.24	10.31	10.61	10.84	9.45	10.37
Oxidation/Reduction Potential	mv	NA	-220	-142	-89	-123	7	4	-51	-5	2	-70	-105
Salinity	PSS	NA	0.13	0.29	0.19	0.28	NM	NM	NM	NM	NM	0.25	0.31
Turbidity	NTU	NA	1.4	47.2	2.5	44.6	-2.3	-2.6	-2.6	1.6	0.5	0.63	7.6
Sulfide	mg/L	NA	0.68	0.80	0.17	0.05	NS	NS	NS	0.00	0.02	0.25	0.07
Dissolved Iron	mg/L	NA	0.00	2.34	0.08	1.95	NS	NS	NS	1.53	0.87	0.00	3.30
Dissolved Manganese	mg/L	NA	0.0	0.0	0.4	1.1	NS	NS	NS	0.2	0.2	0.00	0.8
Biogeochemical Parameters													
Nitrogen, Ammonia	mg/L	<0.050	<0.050	0.085	<0.050	0.13	NS	NS	NS	0.11	0.094	0.14	<0.050
Total Organic Carbon	mg/L	2.1	22	1.9	1.3	1.6	NS	NS	NS	1.5	1.1	1.8	<1.0
Nitrogen, Nitrate	mg/L	<0.050	<0.050	<0.050	<0.050	<0.050	NS	NS	NS	<0.050	0.31	<0.050	0.054
Nitrogen, Nitrite	mg/L	<0.050	<0.050	<0.050	<0.050	<0.050	NS	NS	NS	<0.050	<0.050	<0.050	<0.050
Sulfate	mg/L	8.2	15	15	<5.0	15	NS	NS	NS	7.1	17	<5.0	20
Chloride	mg/L	1.1	13	3.4	<1.0	5.5	NS	NS	NS	4.3	13	2.4	4.6
Total Alkalinity	mg/L	310	90	300	240	300	NS	NS	NS	300	360	280	320
Dissolved Gases													
Ethane Gas in Water	µg/L	<1.0	8.2	<1.0	<20	<1.0	NS	NS	NS	<4.0	<1.0	<10	<1.0
Ethane Gas in Water	µg/L	<1.0	2.1	<1.0	<20	<1.0	NS	NS	NS	10	<1.0	<10	<1.0
Methane Gas in Water	µg/L	3.1	16	12	660	18	NS	NS	NS	91	5.1	240	<0.50

**Notes:**

ND (5.0) -Not detected above analytical method  
reporting limits are listed in parenthesis.

S.U. -Standard Units  
NTU -Nephelometric Turbidity Units  
µS/cm -MicroSiemens per Centimeter  
mg/L -Milligram per Liter  
µg/L -Microgram per Liter  
C° -Degrees Celsius  
mv -Millivolt  
PSS -Practical Salinity Scale  
NA -Not available.  
NS -Sample location not sampled



**Table 5**  
**Summary of Analytical Data**  
**Influent Effluent Conc.**  
**Groundwater Extraction and Treatment System**  
**Rose Township Site**  
**Units as Given**

Sampling Month: Sample Date:		Discharge Limitations	October Data 10/02/06 10/02/06		October Data 10/09/06 10/09/06		October Monthly Average Effluent
Site Identification:		See footnote after table 1	Influent	Effluent	Influent	Effluent	
<i>Compound Name</i>	<i>Units</i>						
Chlorobenzene	ug/L	5(m)	-	-	-	-	<1
Methylene chloride	ug/L	5(m)	-	-	-	-	<1
1,1,1-Trichloroethane	ug/L	5(m)	-	-	-	-	<1
Trichloroethylene	ug/L	5(m)	-	-	-	-	<1
Vinyl chloride	ug/L	3(m)	23	<1	25	<1	<1
Benzene	ug/L	5(m)	-	-	-	-	<1
Toluene	ug/L	5(m)	-	-	-	-	<1
1,2-Dichloroethylene	ug/L	NA	12	<2	11	<2	<2
PCB: aroclor 1016	ug/L	*	-	-	-	-	<1
PCB: aroclor 1221	ug/L	*	-	-	-	-	<1
PCB: aroclor 1232	ug/L	*	-	-	-	-	<1
PCB: aroclor 1242	ug/L	*	-	-	-	-	<1
PCB: aroclor 1248	ug/L	*	-	-	-	-	<1
PCB: aroclor 1254	ug/L	*	-	-	-	-	<1
PCB: aroclor 1260	ug/L	*	-	-	-	-	<1
Arsenic, total	ug/L	50(a)	-	7	-	7.4	7.2
Bis(2-ethyl hexyl)phthalate	ug/L	5(m)	-	<5	-	<0.5	<5
Isophorone	ug/L	5(m)	-	-	-	-	<5
Lead, total	ug/L	14(a)	-	<1	-	<1	<1
Naphthalene	ug/L	5(m)	-	-	-	-	<5
Pentachlorophenol	ug/L	0.8(a)	-	-	-	<0.5	<0.5
Air Emission Rate	lbs/hr	1.0 †	0.0036		0.0032		
Cumulative Mass Removal	lbs		434.59		435.19		

- = Not Analyzed

\* = Discharge limitation is 0.00002 ug/L for  
total PCB's.

† = The air emission discharge limitation of 1.0  
pounds per hour includes the emissions  
from the soil vapor extraction system.

(a) = Monthly Average

(m) = Daily Average

4.6 = Analyte above method detection limits (MDL)

SD = Serial dilution was not required for this sample  
because the analyte was 100 times the MDL

**Table 5**  
**Summary of Analytical Data**  
**Influent Effluent Conc.**  
**Groundwater Extraction and Treatment System**  
**Rose Township Site**  
**Units as Given**

Sampling Month: Sample Date:		Discharge Limitations	November Data 11/21/06 11/21/06		November Data 11/27/06 11/27/06		November Monthly Average Effluent
Site Identification:		See footnote after table 1	Influent	Effluent	Influent	Effluent	
<i>Compound Name</i>	<i>Units</i>						
Chlorobenzene	ug/L	5(m)	-	-	-	-	<1
Methylene chloride	ug/L	5(m)	-	-	-	-	<1
1,1,1-Trichloroethane	ug/L	5(m)	-	-	-	-	<1
Trichloroethylene	ug/L	5(m)	-	-	-	-	<1
Vinyl chloride	ug/L	3(m)	20	<1	22	<1	<1
Benzene	ug/L	5(m)	-	-	-	-	<1
Toluene	ug/L	5(m)	-	-	-	-	<1
1,2-Dichloroethylene	ug/L	NA	24	<2	15	<2	<2
PCB: aroclor 1016	ug/L	*	-	-	-	-	<1
PCB: aroclor 1221	ug/L	*	-	-	-	-	<1
PCB: aroclor 1232	ug/L	*	-	-	-	-	<1
PCB: aroclor 1242	ug/L	*	-	-	-	-	<1
PCB: aroclor 1248	ug/L	*	-	-	-	-	<1
PCB: aroclor 1254	ug/L	*	-	-	-	-	<1
PCB: aroclor 1260	ug/L	*	-	-	-	-	<1
Arsenic, total	ug/L	50(a)	-	4.9	-	5.5	5.2
Bis(2-ethyl hexyl)phthalate	ug/L	5(m)	-	<5	-	<0.5	<5
Isophorone	ug/L	5(m)	-	-	-	-	<5
Lead, total	ug/L	14(a)	-	<1	-	<1	<1
Naphthalene	ug/L	5(m)	-	-	-	-	<5
Pentachlorophenol	ug/L	0.8(a)	-	-	-	<0.5	<0.5
Air Emission Rate	lbs/hr	1.0 †	0.0006		0.0037		
Cumulative Mass Removal	lbs		438.44		438.53		

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total PCB's.

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from the soil vapor extraction system.

(a) = Monthly Average

(m) = Daily Average

4.6 = Analyte above method detection limits (MDL)

SD = Serial dilution was not required for this sample  
because the analyte was 100 times the MDL

**Table 5**  
**Summary of Analytical Data**  
**Influent Effluent Conc.**  
**Groundwater Extraction and Treatment System**  
**Rose Township Site**  
**Units as Given**

Sampling Month: Sample Date:		Discharge Limitations	December Data 12/06/06 12/06/06		December Data 12/14/06 12/14/06		December Data 12/19/06 12/19/06		December Data 12/27/06 12/27/06		December Monthly Average Effluent
Site Identification:		See footnote after table 1	Influent	Effluent	Influent	Effluent	Influent	Effluent	Influent	Effluent	
<i>Compound Name</i>	<i>Units</i>										
Chlorobenzene	ug/L	5(m)	-	-	-	-	-	<1	-	-	<1
Methylene chloride	ug/L	5(m)	-	-	-	-	-	<1	-	-	<1
1,1,1-Trichloroethane	ug/L	5(m)	-	-	-	-	-	<1	-	-	<1
Trichloroethylene	ug/L	5(m)	-	-	-	-	-	<1	-	-	<1
Vinyl chloride	ug/L	3(m)	23	<1	23	<1	18	<1	22	<1	<1
Benzene	ug/L	5(m)	-	-	-	-	<1	<1	-	-	<1
Toluene	ug/L	5(m)	-	-	-	-	<1	<1	-	-	<1
1,2-Dichloroethylene	ug/L	NA	17	<2	16	<2	15	<1	17	<2	<2
PCB: aroclor 1016	ug/L	*	-	-	-	-	<1	<1	-	-	<1
PCB: aroclor 1221	ug/L	*	-	-	-	-	<1	<1	-	-	<1
PCB: aroclor 1232	ug/L	*	-	-	-	-	<1	<1	-	-	<1
PCB: aroclor 1242	ug/L	*	-	-	-	-	<1	<1	-	-	<1
PCB: aroclor 1248	ug/L	*	-	-	-	-	<1	<1	-	-	<1
PCB: aroclor 1254	ug/L	*	-	-	-	-	<1	<1	-	-	<1
PCB: aroclor 1260	ug/L	*	-	-	-	-	<1	<1	-	-	<1
Arsenic, total	ug/L	50(a)	-	14	-	6.1	-	5.4	-	5.9	7.9
Bis(2-ethyl hexyl)phthalate	ug/L	5(m)	-	<0.5	-	<5	-	<5	-	<5	<5
Isophorone	ug/L	5(m)	-	-	-	-	-	<5	-	-	<5
Lead, total	ug/L	14(a)	-	<1	-	<1	-	<1	-	<1	<1
Naphthalene	ug/L	5(m)	-	-	-	-	-	<5	-	-	<5
Pentachlorophenol	ug/L	0.8(a)	-	<0.5	-	-	-	<0.5	-	-	<0.5
Air Emission Rate	lbs/hr	1.0 †	0.0038		0.0048		0.0029		0.0042		
Cumulative Mass Removal	lbs		439.33		440.07		440.64		441.20		

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total PCB's.

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pounds per hour includes the emissions  
from the soil vapor extraction system.

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(m) = Daily Average

4.6 = Analyte above method detection limits (MDL)

SD = Serial dilution was not required for this sample  
because the analyte was 100 times the MDL

**Table 6**  
**Summary of Operational Flow Data**  
**Groundwater Extraction and Treatment System**  
**Rose Township Site**  
**4th Quarter 2006**

Well ID	Oct-06			Nov-06			Dec-06		
	Monthly Total (Gallons)	Flowrate (gpm)	% Operation	Monthly Total (Gallons)	Flowrate (gpm)	% Operation	Monthly Total (Gallons)	Flowrate (gpm)	% Operation
PW-1	1413857	17	37	2137500	49	48	5571643	125	100
PW-3	1445000	32	37	368000	9	28	1696143	38	100
PW-4	748429	17	37	769500	18	30	2528214	57	98
PW-6	1242571	28	37	1667000	39	32	5172143	116	100
PW-7	536429	12	37	383000	9	48	948857	21	100
PW-8	512286	11	37	387500	9	48	1258643	28	100